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COMMUNICATIONS

TO THE

BOARD OF AGRICULTURE.



COMMUNICATIONS

TO THE

BOARD OF AGRICULTURE;

ON SUBJECTS RELATIVE TO

THE HUSBANDRY,

AND

INTERNAL IMPROVEMENT

OF THE COUNTRY.

VOL. IV.

——— ARATRO
DIGNUS HONOS——— GEORG.



LONDON:

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1805.





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P. 344, last line, and p. 345 line 1, for *and the other is sown with wheat, on wheat stubble; she plants potatoes in rows,* &c. read *and the other is sown with wheat. On the wheat stubble she plants potatoes in rows,* &c.

EXTRACTS FROM ESSAYS

SENT

IN CLAIM OF PREMIUMS OFFERED

ON THE

CONVERSION OF GRASS LANDS,

AND REWARDED BY THE BOARD.

A CATALOGUE
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——— Naked.
——— Winter.
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—— Tick.
—— Mazagan.
Broom. Common yellow,
Buck, or French wheat.
Burnet.

Cabbage. Gibb's true drum-head, for cattle.
——— Scotch.
——— American.
——— Large red.
——— Long-sided.
——— White turnip above ground.
——— Purple ditto ditto, or kohl rabi.
——— White turnip under ground.
——— Tall green borecole.
——— Tall purple ditto.
——— Siberian hardy sprouting.
Carrot. Large thick orange, for cattle.
——— Large thick red, ditto.
Canary.
Chicory.
Clover. Common red.
——— Perennial, or cow-grass.
——— White Dutch.
——— Yellow, trefoil, nonsuch, or black grass.
Clover. Malta.
——— Providential.

Flax, or linseed.
Furze.

Grass. Meadow foxtail.
—— Meadow fescue.
—— Sheep's fescue.
—— Hardish fescue.
—— Purple ditto.
—— Float ditto.
—— Crested dogstail.
—— Rough cocksfoot.
—— Tall oat-grass.
—— Yellow ditto.
—— Meadow ditto.
—— Sweet vernal.
—— Great meadow.
—— Common ditto.
—— Marsh ditto.
—— Compressed ditto.
—— Annual ditto.

Grass. Common ray-grass.
—— Peacey ditto.
—— Improved perennial do.
—— Timothy.
—— Yorkshire.
With many other sorts.

Hemp. Russian.
——— English.
Honeysuckle. French.

Lettuce. Large Coss.
Lentils. Small.
——— Large.
Lucerne.

Mangel wurzel.
Maw-seed.
Medicago, various sorts.
Millet. Red.
——— White.
Mustard. Brown.

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—— Poland.
—— Potatoe.
—— Flanders.
—— Caspian.
—— Black.

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Parsnip. Large thick.
Pea. Gibbs' best early.
— Marlborough grey.
— Large grey rouncival.
— Early white.
— White boiling.
— Pearl.
— Blue Prussian.
— Maple.
Potatoes. Ox-noble.
——— Late champion.
——— Large red.
——— Nicholson seedling.
——— Bomb-shell.

Rib grass. Lamb's-tongue, or
——— Upright plantain.
Rape, or coleseed.
Rye,

Sainfoin.
Saridella.

Tares. Spring.
—— Winter.
—— White.
—— Perennial.

Trefoil. Birdsfoot.
——— Common, various sorts.
Turnip. Early stone.
——— White Norfolk.
——— Norfolk bell.
——— Stubble.
——— Green top.
Turnip. Red top.
——— Large yellow.
——— Globe.
——— White tankard.
——— Green ditto.
——— Red-top ditto.
——— Large Dutch.
——— True yellow Swedish, or ruta baga.
——— White Swedish.

Vetch. Kidney.
—— Chickling.
—— Pale-flowered.
—— Everlasting.
—— Great wood.
—— Six-flowered.
—— Tufted.
—— Bush.
—— Hoary.
—— Sainfoin.
—— Red-flowered.
—— Biennial.
—— Bastard.
—— Broad-podded.
—— Rough.
—— Single-flowered.
—— Narbonne.
—— Flat-podded.
—— Hairy ditto.
—— Narrow-leaved.
—— Streaked.
—— White-flowered.
—— White-seeded.
—— Horse-shoe.
—— Milk.
—— Liquorice.

Weld.
Wheat. Red Lammas.
——— Common white.
——— White hedge.
——— White Siberian,
——— Egyptian.
——— Sicilian.
——— Round African.
——— Zealand.
——— Cape,
——— Dantzick.

Woad.

Yarrow.

COMMUNICATIONS, &c.

I.

ON CERTAIN SOILS, AND THEIR CULTIVATION.

No. I.

CLAY.—*By Mr. Thomas Best, of Hazelbury, near Crewkerne.*

HAVING ninety-three acres of land (which I hold under Edward B. Portman, Esq. for 99 years, or determinable on three lives) that had lain for a great number of years in a very uncultivated state, I was determined to try, if possible, to improve them. My neighbouring farmers endeavoured to dissuade me from it, saying, that I should never see principal or interest. The improvement however has answered my utmost wishes, of which the following statement will, I presume, be a sufficient proof. These lands, since the memory of man, were let at £ 18. per annum: from this sum they increased, owing to the advance of the times, to £ 22. 5*s.* which is the most they were ever let for. In the year 1788 I began on a field of eight acres, by employing some men to take up brambles, furze, and other natural incumbrances, with which, two parts in three of that field were covered; in the winter I had it under-ground drained. This, I think, is the first step which a farmer ought to take, before he converts his land to tillage. I laid the top turf on two shoulders, about sixteen inches deep, leaving a channel open under, which got the land very dry, and so it continues. The expence of draining, when I first began, was about 30*s.* per acre, but now it is near 40*s.* In December 1790 I ploughed the whole of this field, and in the February following spread about ten tons of well mixed dung and earth over every acre. In April I sowed it with flax; this is a crop that

requires (particularly in strong lands, which this is, being on a strong clay, with some spots of flinty gravel) in its early part, at least twelve hours rain every week. Unfortunately for me, we had not half rain enough; consequently that crop failed. I then made as good a fallow as the nature of the land, and the season would permit At Michaelmas, 1791, I sowed it with wheat, which produced about eighteen bushels (single Winchester) per acre. As soon as the ground was cleared of the wheat, it was ploughed and sown to vetches, of which I had a great crop: I fed these off with sheep in the spring 1793, and the ground which they cleared by day, they lay on, at night. After the vetches were all eaten, I made a very good fallow, and in September dressed it over with ten hogsheads of lime (which cost 1*s.* 6*d.* per hogshead) per acre, which I had in the month of May mixed with the head-lands well together. About Michaelmas I sowed it with wheat again, and had too great a burden; for in the month of May 1794 I was obliged to have a man, with a keen reap hook, to cut off all the luxuriant blades, the ear not having made its appearance. This precaution, however, did not fully answer my purpose, for a great part of the crop was thrown, nothwithstanding I had full twenty-five bushels per acre. I then made a fallow, and in the spring 1795 sowed the field with white oats, and grass-seeds of different sorts, viz. rye-grass, cow-grass, dutch clover, and hop. The oats were very thick and long, in consequence of which, the grass plants in some places did not thrive, for in spots of five or six feet square, there was no appearance of any. I had eight quarters of oats per acre. I fed the grass with sheep the years 1796, 1797, and till August 1798, when I again ploughed it, and dragged in some vetches. I had a great crop, and in the spring 1799 fed it off with sheep, folding them on the ground, as they eat the vetches. When this was done, I made a fallow, as good as a wet summer would admit of, and sowed it to wheat again, at the usual season, without any additional manure, and had about twelve bushels per acre, a good crop for this year, some lands in this neighbourhood not producing more than six or seven. The acre in this country is customary measure, not statute.

Finding this land drained so well, I have every winter drained a little, as fast as I could get the land cleansed, and last winter I completed the whole ninety-three acres. I have drained a great many acres of land, besides these, and have had it done in the same manner, which answers extremely well. Twenty acres of the above ninety-three, I have kept in pasture, having, in the space of five or six years,

dressed it over twice, with about fifteen tons per acre each time. My manure consists of dung, earth, soap-ashes, and the scrapings of the turnpike roads: this latter article answers remarkably well on a strong clay soil. The whole of these ninety-three acres are on such a soil, with some gravel. During the summer it is necessary to turn it twice, in order that it may be well mixed; and by doing this, it is brought to a fine mould; when spread on the lands, once brushing over with some thorns, makes it soon disappear. The above twenty acres are at this time worth 25*s.* per acre. In November 1795 I began ploughing another piece of ground of fourteen acres. From the manner in which this piece of ground lay, my servant could not throw it plain (it being left, the last time it was ploughed, in six-furrowed ridges), so as to bring it with any advantage to a crop in the spring. In April 1796 I ploughed it across, after this worked it well with drags and harrows. Finding this would not do (owing to the turf not being sufficiently rotten, which I account for, by lying in a rough open state all the winter), I set some men to hack it over; and harrowing it well with four horses abreast, it became tolerably fine, with the exception only of the rush and sedge, of which there was a great abundance. The weather being dry, I employed twelve or fifteen women and boys beating over these rush and sedge roots, in order to get them out of the earth, some men going after them with three-pronged forks, throwing it in heaps, and burning it. By doing this, I raised a great number of ashes, which I spread over the land, and as soon as sufficiently cold, I harrowed in some turnip-seed, which came up very well; but the land being of a close stiff nature, they did not get larger than about the size of a cricket ball; I had them hoed, otherwise they would not, in my opinion, have grown to that size. I kept 450 sheep on them, with a little hay, a month and a few days. In the month of May previous to this, I put on the headlands 140 hogsheads of lime, which I caused to be well turned and mixed, and as the sheep ate the turnips, this was carried and spread on the land. The latter end of October it was sown with wheat, and produced a good crop, averaging better than twenty bushels per acre. As soon as the wheat was carried off, it was ploughed, and sown to vetches (a greater burden than lands of the value of 40*s.* per acre could produce), and in the spring 1798 fed them off with sheep, folding them by night, where they fed by day. I always make it a point, as soon as the sheep have cleared a day's work for the plough, to plough the land; by doing this I preserve the manure of the sheep from the sun, and turn in what vetches were

left, which in my opinion is equal, if not superior, to the droppings of the sheep. I have observed that where the greatest quantity has been left and ploughed in, that part of the ground generally works much lighter, at seed time; and that at harvest, the wheat is superior. This may not do so well on a light sandy loam. I finished sowing this field to wheat (the second time) by Michaelmas 1798. I was obliged in May to cut off all the tops of it (as I did in the other field) in order to keep it standing. When harvest came, I had sixty tithing per acre, which produced no more than 300 bushels and about two pecks, in the whole field. If the kern had been such as it was the year before, I should, I believe, have had thirty bushels per acre. Last year it was sown to barley and grass-seeds. As the barley is not thrashed, I cannot state exactly the quantity grown, but from appearance, it was judged to be about twenty bushels per acre; a good crop for this country last season; the grass plants looked remarkably well, and consist of the following sorts, rye-grass one peck, cow-grass 6lbs. dutch clover 2lbs. cock-grass 2lbs; this I allowed for every acre. It is customary in this country for the tenant to be at the expence of the grass-seeds. The hop-grass did not answer in the other field; it is my opinion that the soil is too heavy and close for it. I very much disapprove of mowing the first year after laying down, particularly on strong lands.

A gentleman living only a mile from me, three years since, laid down a piece of land entirely with cow-grass, the soil very similar to mine. Having no sheep to feed it with, he mowed it twice the first year. By doing this, the grass plants, &c. were completely killed. It is my opinion that the feeding off young grass with sheep will improve it, as well as improve the land, particularly rye-grass; for if this is once suffered to get long and dry, no cattle will feed on it. Cow-grass and Dutch clover appear to me to flourish most on strong lands. This and every other sort of grass-seed, I should recommend to be sown with flax, barley, or black oats, and for these two reasons: flax is in general sown from the middle of April to the early part of May, and drawn the early part of July, the roots of the flax being so small the grass plants are not injured by drawing it; on the contrary, it moves and adds fresh earth to the plant. If the land is good for barley, I should prefer it to oats, because, in general, oats are sown thicker than barley, and consequently, the sun and air are more excluded from the grass plant. If oats must be sown, I should sow the small black oat, the straw being so much finer in the stalk, and much shorter. The sun and air having more power, the grass plants of course get much stronger.

In November 1796 I ploughed another field of eleven acres, and threw it very plain. As soon as it was finished ploughing, I had it rolled with a heavy roller, that it might lie as close as possible all the winter, in order to rot the spine or turf, the better. In the early parly part of April I dragged in some black oats; shortly after they were up, an easterly wind (to which this field lay quite exposed) struck them very yellow, exactly like straw, and the ground being so very poor, they never recovered it. The ground lay in this state till September, when it was ploughed across, and so it remained till the March following. The frost having opened it, and by dragging and harrowing it well, I brought it to be tolerably fine. In May I dressed it over with 20 hogsheads of lime per acre, (which was well mixed with the headlands in April,) then ploughed it as thin as possible, and sowed some turnip-seed, which came up very well, but did not flourish, owing, in my opinion, as I have before observed, to the soil being too stiff and heavy for turnips. At Michaelmas 1798 it was sown to wheat, without any other manure. The crop produced me nineteen bushels per acre. As soon as the wheat was carried off the land, I sowed it to vetches (which I am convinced from experience, is the best artificial sowing on strong lands), and I had a very good crop, which I fed off with sheep, in the same manner as before described, and last Michaelmas it was sown the second time to wheat, without any additional manure; at present it is impossible for plants to look better. I intend taking three crops from this field, as I did from the last, and then to lay it down for three years, I think no land should have more than three crops of corn, without rest; at the same time sowing between those crops, some sort of artificials for sheep-feed, which will keep the land clean, and in good condition. The soil will dictate to the farmer what sort of artificials to sow for his advantage. I have at this time another field of ten acres in fallow which has been ploughed these twelve months. I intend pursuing exactly the same method with this, and the remaining thirty acres, as I have done with the former, and when finished, I have no doubt but that the ninety-three acres will be worth one hundred pounds per annum.

I trust it will appear, by the experiments which I have made, how practicable it is to improve a great part of the waste lands of this kingdom. The expences at first sight appear great, but the industrious farmer would very soon find his advantage, by laying out a few pounds, in the same manner as I have before described. I have been more particular in pointing out the different crops that I have had,

than perhaps is absolutely necessary; but my reason for doing this is, that the Honourable Board may the better be enabled to judge of the expence, and of the profit; likewise the great advantage that may follow to the community at large by converting *such lands* to good pasture and tillage.

No. II.

Clay.—*By John Deverall, Esq. of Clifton, Nottinghamshire.*

A field of strong red clay grass land of eight acres, under lease of twenty-one years, worth 20*s.* per acre per annum, in my occupation, had been down twenty-five years. In 1784, I ploughed it up and sowed peas and beans, about two peas to one bean: I had a good crop, twenty-four bushels per acre. In the autumn I sowed it with wheat, and in 1785 had a produce of twenty-four bushels per acre. In 1786, I fallowed, manured, and limed it, then sowed rape or cole had a very good crop, which was fed on the land with sheep, and answered well. In 1787, it was sown with barley and grass-seeds: the barley produced fifty bushels per acre. This field has been grazed fourteen years since, chiefly with sheep and some beasts, and has carried a fifth more stock, than it would have done previous to the ploughing.

No. III.

Cold Soil on stiff Clay.—*By Mr. John Bourdon, of Rotherby, Leicestershire.*

Were I to fix on the land which in my opinion would be most benefited by the plough, and which under a proper cultivation would probably produce almost as good crops of wheat as any the very best land, it would be a cold soil on stiff blue clay. Land of this quality, while under grass, is never of much value, either to the owner or the occupier, and is of little or no use to the community, as the food produced on it, is very inconsiderable indeed. On breaking it up and managing it in a husband-like manner, a new order of things arises; from being the abode of poverty, it suddenly becomes the source of plenty, and repays the cultivator tenfold for his expence and trouble.

Having some years since entered upon a farm of this nature, which I flatter myself is considerably improved, I shall presume to submit my mode of management to the attention of the Board.

As the land was extremely poor and wet, my first object was to lay it dry; and having ascertained the cause, I drained it, either by tapping according to Mr. Elkington's plan, or by hollow draining it up each furrow, at the distance of, from seven to ten yards, as the nature of the case required; but it must not be concealed, that hollow draining in soils of this nature, is generally the most requisite.

Draining I consider to be absolutely necessary, if any permanent improvement is intended, as nothing so amply repays the expence; for it not only prevents the rot in sheep when fed, but the manure lasts longer, it requires less seed, bears considerably better crops, which are ripe by more than a fortnight sooner than those which grow on lands not drained; and as a still greater advantage, two horses will be sufficient to work it, where three were before required.

The land being thus prepared, at my own charge, I broke up a part of it and sowed it with oats; the remainder I floated and burnt. In doing this, I took particular care to pare as thin as possible; and as black ashes are highly advantageous,

from the quantity of salts they contain, I took particular care to burn the turf in very gentle fires, in order that the salts might not evaporate, which would have happened, had the turf been burnt to a brickish red. These ashes I spread upon the land, and then ploughed it and sowed it with turnips: I was, however, cautious to plough thin, in order that the turnips might have the benefit of the ashes.

This plan, I believe, is not common, for it is usual after burning to sow with wheat, but I give the preference to a turnip crop, from the great improvement which the land receives by eating them with sheep. And here I must remark, that having hollow-drained the land, I found it as well adapted for feeding sheep as the lightest soil, and have no doubt but that clay-land, if drained, would invariably be well adapted for the purpose. My next crop was barley laid down with clover, fourteen pounds per acre: this I fed the summer following with sheep, which should always be done, for mowing the clover certainly tends to impoverish the ground. In the autumn I again broke up the land, ploughing in a good quantity of clover, and sowed it with wheat. When this was harvested, and candlemas arrived, I fallowed the land; and as soon as the spring seed-time was over, I spread from seventeen to twenty tons of manure a year old, (for I find new manure to retain the wet so much, that it is disadvantageous to wet soils,) per acre. I then ploughed it in, used a scuffle (something similar to Cooke's patent scuffle), and worked the land till quite clean; being of opinion, that a scuffle, from its mixing the manure with the soil, as well as from its increasing the quantity of soil, is better adapted at this period for the purpose than a plough. I afterwards, at a proper time, ploughed and sowed with turnips, and eat them off with sheep as before, making it a point to clear the land before candlemas, which gives the soil an opportunity to be lightened by the frosts, and produces a better crop of corn afterwards.

Having now brought the land into such a state, that it is either fit to be continued under the plough, or to be laid down considerably improved; if the former is resolved on, I sow with barley and clover and follow with wheat and turnips, as before described; but if I wish to lay it down, I sow it with barley and the following seeds: nine pounds of white clover; five pounds of red clover; three pounds of trefoil; one gallon of rye grass; and on every account, recommend the land to be fed for some time with sheep before it is mown.

Having thus stated my course of husbandry I must add, that at the time I entered upon the land, it was not worth more than 10*s.* per acre; whereas, I now

pay £1. for it, notwithstanding I have been at the sole expence in improving it; and that as grazing land, it did not produce per acre, at most, more than fifty pounds of human food; whereas, it now produces five hundred pounds of solid food, deducting five hundred pounds as offal, on an average of four years per acre.

No. IV.

COLD WET LOAMS.—*By Mr. Benjamin Cotton of Weybread, near Harleston, Norfolk.*

THE ordinary part of pasture land (for no one would think of breaking up the richest), which ought to be converted into tillage, and which has come under my management, consists here in general of rather a thin-skinned cold soil, a wet loam, perhaps three inches deep; next thereto is a yellow brick earth about the same depth, below which there is found a pretty strong clay. The produce of this land, to a very great extent, is almost invariably a coarse sedgy grass of a blueish cast, coming late in the summer, and when come, extremely rough and *edged barsh.* The improvement to be made in this land is very great, and the process easy: the best way, as I have found from experience is, to lay on in the autumn at least eighty loads of clay per acre (about twenty-eight cubic feet each load), and to spread the same immediately. Having early in the previous spring under-drained the said land (most of which soil is in need thereof), at the depth of twenty-two inches, and distance of fifteen yards. These drains should be drawn out by a plough the depth of six inches, obliquely crossing the intended ridges so as to have a moderate fall, and often one spit of sixteen inches will be sufficient to finish the same so far as the opening goes. They should each be carried through separately, if possible, into the ditch which carries off the water from them; for in this case, there will be less hazard of stoppage than in several united into *one* principal, which, if by accident it *is* stopped, prevents the working of all. I am aware that many will think the depth of those drains too little, and the number too few, but I am convinced of the contrary: the land after it is again returned to pasture, will be better than if *more,*

or at a greater depth were cut. This will not cost more than one half the expence of the usual mode of draining at thirty-two inches deep, and about eight yards asunder. The water will be much more quickly taken off, if these twenty-two inch drains are filled up with stones (broken small), or bushes, eight inches deep; then with bean-stalks, fern, or haulm, six inches more; after which, lay on the flag, the grassy part downwards, then the loose mould together eight inches. In the deep process, the filling up is often erroneously begun with the clay, and trodden twelve or fourteen inches deep; so that the water, even *directly over* the same, is a long time in finding, if it ever does find, its intended passage.

The clay in or under such soil, as we are now speaking of, is in great plenty, and in general, the properties thereof rich and fertile. The white chalky clay, abounding in small chalk stones, should be selected: being equally spread, the first four or five frosty nights will often pulverise it so, that the harrows may be used to great effect. Lying yet a few weeks in the midst of winter, and being repeatedly frozen, one harrowing more will bring it to a fine state for the plough, incorporated in a great measure with the sod, and stirred in various exposures to the atmosphere. This manure will not only be enriched, but its effects will far more speedily be given than if turned in immediately after its being carried on.

The course of crops and proceedings for the term of eight years, should be as follows: 1st. pease, in the month of February ploughed up the depth of three inches only. As soon as seasonable weather invites, plant on the best land white, or on inferior gray pease, by dibbling and dropping; ten pecks per acre; being drained, and this ploughing to remain until the pease are off: there is no fear of *wet*, and the ridges may be ploughed very large as most convenient. As early as possible after this crop is carried off, the land should be twice or thrice harrowed, cleared, and immediately ploughed *across* at the depth of five inches: thus the clay will be turned into the midst of the soil, and soon mixed in a just proportion. After three or four harrowings, in a short time, turn that ploughing back again across and harrow it well; say four or five times. In the month of October plough it (as at first), in the direction to give the best descent, into very small ridges, to receive all possible advantages from frost and weather: it will now be in a fine state. The middle of March, these small ridges being split down with the plough, it will safely lay two or three weeks; then after harrowing, plough and sow the same with second crop oats, four bushels per acre. The land being fresh and in good tillage,

no doubt need be entertained of an abundant produce. I would adopt this plan of oats in preference to wheat sowing at the Michaelmas, not only on account of the hazard to be apprehended from the wire-worm, so frequent in its depredations on the latter in new land, but also for the opportunity of bringing the premises into a speedy good tilth. This being now done, I proceed, in the third year, to sow turnips, after a clean summer tilth as usual, well manured: the turnips to be carted off and given to cattle or sheep as circumstances may point out. The difficulty of growing turnips I am convinced is much less than is generally imagined on lands of most descriptions: on many, indeed, they are easily obtained, but very wet land is unfavourable on two accounts, *viz.* they cannot be fed on the land, or easily carted off; yet these difficulties are considerably mitigated, if not done away by underdraining. Very strong and cold lands, which produce them too small for notice, will, by applying light manure with plenty of sand, pot-ash, or rich mould, soon shew to the attention of their occupier, a grateful proof of their improvements; and very light soils, which seldom suffer the turnip to escape a disease in its root which soon carries it off, are cured, and this ill effect assuredly prevented by a plentiful application of clay or marle. But to our fourth year; barley, with twelve pounds an acre of good clover seed. The land being fresh and new thereto, will, in all probability, produce a good and full plant: should it fail, beans may be planted, or tares. Then fifth year, clover (or beans or tares); and sixth year wheat, after which, in the seventh year, a summer tilth and turnips. This crop demands a strict attention and effectual cleaning, five or six times ploughing, and three times as many harrowings, small dressing of manure, put on ridges as large as the nature of the land will admit, about the end of April. In the eighth year barley, three bushels per acre, to be harrowed in. I need not observe that the land should be ploughed at least three times after the turnips are off, before the barley is sown. I have then five sacks (four bushels each) of hay-seeds, procured from the cleanest and finest pasture, sown on every acre; and *afterwards*, for if mixed with the light seeds they will be very unequal in their appearance, I sow six pounds per acre of red and white clover (suckling), half each, carefully mixed, harrowing in these seeds with light harrows two or three times, and roll down with a light roller.

It would be most eligible that the tenant should provide these seeds, which will cost about thirty shillings per acre.

Experience has convinced me beyond all doubt, that it is far preferable to mow

the grass in the first year after laying down. I would roll down the field with a heavy roller immediately after the barley is carted off, and not suffer any cattle or sheep to depasture thereon, until after the first crop of grass is mowed and taken off. The young and tenderly rooted plants, before subject to injury from treading, will *now* be secure, and the sooner the after-math is fed, the better. Much foddering in the winter is injurious; I would recommend a thin coat of fine and heavy manure, (the last was a slight one, or the barley would have heen too luxuriant for the growth of the small seeds), then let a *bush-harrow* and a roller afterwards finish the process.

I made an experiment on two small inclosures, of four acres each, how far tillage would extirpate a weed, which is very common in Suffolk on this kind of pasture, bearing a yellow flower, and growing very thick, about a foot high, having the appearance in autumn of thistles turned brown, and commonly there called "mare-fat:" it closely covered at least one half of each inclosure. This land was then (twenty-one years since) let at about 17*s*. per acre. I had the same managed exactly as before described, and the produce during the eight years, like all other experiments on nearly the same land, was very good, *viz*. on the average, of pease seven combs per acre; oats sixteen; turnips sold at £4. per acre; the barley crop produced ten combs an acre; clover, mowed twice, near two tons; wheat six combs; turnips good, and barley again the same. One of the four acre inclosures is yet continued in tilth, and occupied at 25*s*. per acre: the other was returned to grass, and let on the 10th of October last, at two guineas an acre, fine pasture; neither have now a root of the "mare-fat."

No. V.

Clayey Loam.—*By Mr. Robert Bolt, of Capell, near Dorking.*

Let us suppose the soil to be a clay strong loam, or of such like retentive nature; if it be springy or of a milchy kind, then draining should be the first thing done: the occupier must judge whether it be sufficiently rich for corn without dung before it is ploughed. Suppose the land to be in Suffolk or Essex, where that kind of clay is to be found intermixed with chalk stones, then the pasture requires a thick dressing with that kind of clay, as marle, with not less than sixty-one dung cart loads on an acre. Winter tares I recommend as the best crop to sow first, and in such case, the land should be clayed this winter, if intended to be ploughed up next autumn, and the clay well trod into the flag with sheep; for if it is clayed and ploughed in directly, it will settle in the dead soil, and when ploughed up again, will not be easily incorporated with it. I think the best way of breaking up old pastures is with a foot plough, with a sharp share to take the flag off thin; then follow with another with a spreading wing, or broad board, to throw the bottom part on the flag, which will be completely buried: the plough with the skimmer on the coulter may do it, but I think not so well. The tares should be sown or drilled in September: drilling is the best way, as the ground may be better hoed in the spring. The tares should be fed off with sheep or beast, but sheep in preference, as they may be folded on the land; but if the ground should be sufficiently rich for corn without folders, then the tares may be mowed off, and given to the cattle in yards, by which means the feed will go much further: the tares should be fed off just as they are getting the bloom. When the tares are cleared from the ground, it should be immediately ploughed up and well fallowed for wheat, not having less than five ploughings. "Boughting" is a good way of ploughing in fallows; that is, turning a furrow on the unploughed ground, and turning the same with another back again in its former place. The ground is better stirred and lies more open to the sun and air; but this must be done after the ground is broken to pieces: harrowing should not be forgotten, but not directly after it is ploughed, as the ground takes good from lying open a short

time. Suppose the land to be in the Wealds of Sussex or Surrey, where that kind of clay, marle, or free chalk, which I have mentioned, is not to be had, then it is necessary to lime for the wheat with at least a kiln of eight dung-cart loads, or six hundred bushels on three acres. After the wheat crop, beans for strong lands I think the best; they should be dibbled or drilled, that the ground may be the better hoed: though I suppose this to be clay land, still I must strongly recommend a fallow for turnips. In such case the ground should be ploughed in the autumn, after the bean crop is off, well water-furrowed, and laid dry during the winter. It is said, that strong lands are not fit for turnips: I grant that they may more frequently fail on heavy lands than on light soils, and that they cannot so easily be eaten off on the former. Few soils, however, are so wet as not to permit their being carted off at some time, and particularly where the land has been under-drained. I must observe that, the sooner the land is drained the better, that it may have time to settle, and form an arch over the drain; by which means, the latter is less liable to be broken into by the plough or the horses. I think that, nine times of ten, when turnips fail upon strong lands, it is through the want of more frequent ploughing, and of bringing the land into a more pulverized state. No less than seven ploughings ought to be given, beside that of the autumn, with due care taken never to plough the land when wet: a good dressing of dung should be laid on for the turnips. I recommend the turnip crop the more, as I know from experience, that the land is more advantaged by a crop of turnips, than if it were for wheat or other spring corn: the farmer, by this mode, will be enabled to keep more stock and to make more dung. After the turnips, barley should succeed, to be laid down with clover: to the crop of clover, one of wheat may succeed. If the ground is intended to be kept in tillage, after the wheat is off, it should be ploughed and harrowed well, until the land is made perfectly clean: it should then be laid into ridges as intended. When the land is thus treated, it should have a good layer of manure: the mixture should consist of soap-lye, of peat ashes, mould from ditches, and dung, of each nearly an equal quantity, and all well-mixed. If the ground is ploughed in ridges, it should be previously laid on; if "boughted," it should be harrowed once: let the mixture lie on the top, and pulverize with the soil during the winter. In the spring sow the corn, and harrow it in well with the dressing. The species called here "sprat barley" I think the best, as growing with a short stiff straw, it is not so likely as others to be laid, or to injure the young seeds. The seeds which I would recom-

mend, are white clover six pounds, trefoil six pounds, rib-grass three pounds, ray-grass two gallons, and natural grass-seeds four bushels. I mean by natural seeds, such as come from meadow hay. The latter should be chosen from a soil as similar as possible to that, in which it is sown: if they be taken from a soil of a different nature, they will soon degenerate, and a sour grass usurp their place. A new laid pasture should be eaten off the first two years, for if mowed, the finer grasses will be checked, and the coarser species encouraged. On the contrary, by feeding off, the finer grasses are encouraged and rendered still more fine: too much of the coarser grass-seeds are sown, as they seed most and at an earlier season. I shall now proceed to mention a circumstance which happened on the farm which I now occupy: the tenant obtained leave of his landlord to plough up an old meadow which was got foul with a prickly weed, called in Suffolk the "rassel:" he was to plough it but once, and lay it down to grass again; he did so, and sowed it with oats, but the seeds did not take. Being tied from ploughing it again, he mudded it from a pond, let the mud lie on the top and take the frosts, then sowed it with oats and seeds again; he had a good crop of oats, the seeds took well, and it is now a good meadow. This circumstance makes me recommend it the more to lay the dressing on the top, and harrow it in with the corn: this was a strong clay.

Fig. 1.



In the above section I have supposed the furrows to be nine inches broad and three inches and a half thick, as the best proportioned size. I am truly sensible that no certain standard can be fixed for the breadth and width of the furrows; that

No. V.

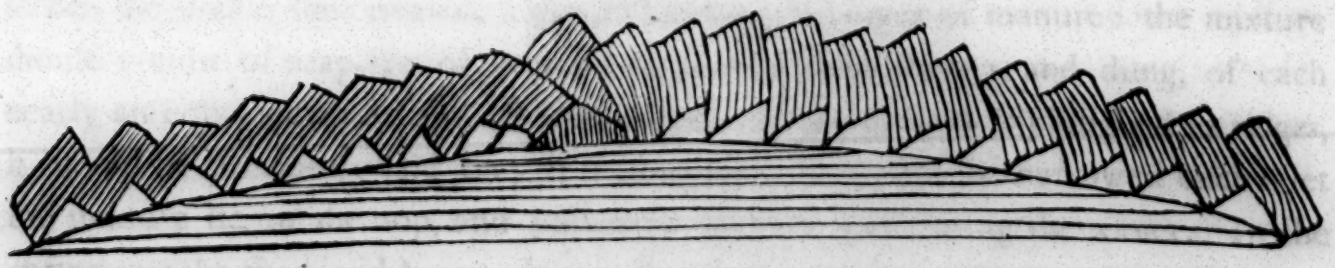
Breaking up, and relaying Clay.—*By Mr. W. Amos, of Brothertoft, near Boston.*

This is the most obdurate and unmanageable soil which the farmer has to encounter, and the too great adhesion of its particles renders it very unfit for vegetation; but this may be in some degree corrected by *lime, sand, ashes, long-dung, marle*; by frequently exposing fresh surfaces of it to the influences of the sun and atmosphere; by planting on it succulent plants, as beans, red clover, &c. which having tap roots, not only render the mass less cohesive thereby, but also add to it much carbon.

The lower leaves of the dense foliage of these vigorous vegetables also give out much carbonic acid by their respiration in the shade; which, perpetually sinking down upon the surface of the soil, supplies it with carbon, which renders it more nutritive to other vegetables, which may afterwards grow upon it.

In breaking up grass land of this kind of soil, great attention should be paid to the mode of ploughing the furrows, so as to expose the greatest surface possible to the influence of the sun and atmosphere, and to furnish the greatest quantity of mould for covering the seed. Words not being able to convey an adequate idea of the perfection of ploughing, I shall therefore, by way of solution, give a section of a ridge of twelve feet broad, properly ploughed, so as to answer those ends most effectually.

Fig. 1.



In the above section I have supposed the furrows to be nine inches broad and three inches and a half thick, as the best proportioned size. I am truly sensible that no certain standard can be fixed for the breadth and width of the furrows; that

must intirely depend upon the depth of the soil. By limiting the breadth and thickness of the furrow as above, I only mean that those proportions should neither be much exceeded nor abated where the staple of the soil will permit.

First Crop.

As the size of the ridges is already formed upon all grass lands, nothing in this case can be done, but to plough the ridges in the manner expressed by the type on the other side, early in February. As soon as the weather permits, in the last week in February, or in the first or second week in March, sow five bushels of good oats upon every acre; then harrow the land only just enough to cover the seed; afterwards let the whole be water-furrowed and drains opened, so that no water may stand upon the land. Nothing more is wanted to be done till the latter end of May or beginning of June, when the crop should be well weeded. The reaping, &c. I leave to the discretion of the agricultor.

Second Crop.

Early in November go over the land and see that no water stands upon it, and that the water-furrows and cross grips or drains are kept clear and open.

As soon in February as the weather and condition of the soil will permit, drill ten pecks of beans upon every acre, twenty-seven inches between each row, and three inches deep; then harrow the ridges twice or thrice with *swinging trees* as long as the ridges are broad; to which as many harrows should be tied as will cover them, and the horses should walk in the open furrows.

As soon as the beans are fairly above ground, they should be rolled and harrowed; some time in May they should be horse-hoed, by ploughing a furrow off from the beans on each side, making a ridge in the intervals between the rows. The beans will then stand upon a ridge of about six or eight inches wide, which must be well hand-hoed. In about a week after, the earth must be returned again to the beans in the rows. In about two weeks more, the double mould-board plough should be used to scour up the middle of the intervals, and to lay the earth closer to the beans. If any more weeds appear they must be pulled up by hand.

As soon as the ground is cleared of the beans, the land should be scuffled the cross way of the ridges, then harrowed once or twice, and the weeds collected in heaps and burnt.

[Here I wish to recommend early sowing; as the mildew is more injurious to late crops than forward ones, owing to the greater dampness of the ground in autumn.]

Third Crop.

Having scuffled, and cleaned the land well, it must then be ploughed up in the manner expressed by fig. 1, four inches deep, if the staple will permit.

If the seed is to be drilled, harrow the ridges twice or thrice in a place, then drill ten pecks of wheat upon every acre, and finish by harrowing the land once; the less harrowing the better, provided there is depth of mould for permitting the seed to be drilled two inches and a half deep.

If the seed is to be sown broadcast, it should be sown after the land is ploughed, at the rate of twelve pecks to the acre; harrow the land just enough to cover the seed; then water-furrow it, and afterwards grip or drain it completely, in both cases.

If the stems and foliage of the wheat are too vigorous, it may be advantageous to eat it down with sheep the latter end of March, or beginning of April, and afterwards to harrow it the length way, and to roll it the cross way of the ridges.

The latter end of May the wheat should be breast or horse-hoed, if drilled; if sown broadcast, the weeding must be done by hand; the same operations should be performed a second time in the month of June. The other operations of reaping, &c. are so well understood, that a particular detail of them would be superfluous.

Fourth, or Fallow Crop.

Early in November, the land should be ploughed across into ridges four inches and a half deep, and afterwards well water-furrowed, and gripped or drained completely. The field will then lie in deep open furrows and high narrow ridges, and consequently will be exposed, to the largest extent of superficies that is possible, which is the *sine quâ non* of ploughing such land. Some time in February, as soon as the season and weather will permit, the ridges must be split down the middle, and reversed, so that the whole surface soil may be equally exposed to the influences of the sun and atmosphere.

About the beginning of April the ridges should be drawn down by the break or drag-harrow going across them once or twice; after lying in this state sometime, the land should get a clean ploughing four inches deep the latter end of the same month. About the middle of May is the best time to lay on the auxiliary earths, viz. four

chaldrons of lime, or six chaldrons of chalk, or fifty tons of calcareous marle, or four chaldrons of ashes, or fifty tons of ashes, or twenty cubic yards of tanner's bark, or fifty tons of sand, or fifty tons of peat earth, &c. upon every acre; then drag-harrow the land both length and crosswise to incorporate the whole intimately together. If the land is very rough, it may be reduced a little either by the spike roller, or a heavyish plain one to a roundish clod; but it should not by any means be made too fine.

If long dung is the intended manure, it should not be laid on till after the second clean ploughing has been given, which should be done the latter end of May in both cases: after the middle of June the dung may be laid on, after the rate of ten or twelve tons to the acre; the land in either case must then be ploughed into ridges of from nine to twelve feet wide, and gathered up in the manner expressed by fig. 1. then sow half a peck of cole-seed upon every acre if sown broadcast, or a quarter of a peck if drilled, and then harrow the whole once. If any weeds spring up they must be hand-hoed, whether the seed has been drilled or sown broadcast.

Eat off the cole in the month of September; then plough the land immediately after the cole has been eaten off three inches and a half deep, reserving the furrows, which must be left clear and open for the sake of draining the land in winter; open also all the cross grips or drains completely, so that no water may be suffered to stand upon the land; for to all improvements, draining is the first step. As soon as the weather permits in April, the land must be ploughed for the last time, into three inches deep furrows, which must be reversed again; reduce the surface to a very fine tilth, by harrowing and rolling it completely for the reception of the seeds. Then upon every acre sow the following seeds.

Of Artificial Grass-seeds.

Cow clover - - -	8 pounds.
White ditto - - -	10 ditto.
Trefoil - - - -	4 ditto.

Of Natural Grass-seeds.

Sweet-scented vernal-grass - -	$\frac{1}{2}$ peck.
Meadow foxtail-grass - - -	1 ditto.
Rough-stalked meadow-grass - -	1 ditto.
Meadow fesque-grass - - -	$\frac{1}{2}$ ditto.
Rye-grass - - - -	2 ditto.

The above composition and proportion of seeds are the most suitable for clayey or moist soils, and will form in two or three years a most excellent meadow, as all the plants sown, are strong and hardy perennials.

After the seeds have been all sown, the land should be bush-harrowed once, the length way of the ridges, and then rolled across.

The next thing to be done is carefully to open all the water-furrows with a double mould-board plough, four inches deep, no width at bottom, but eight inches wide at top. Then open all the cross grips or main drains in the manner expressed by fig. 2. Afterwards roll the whole down the cross way of the lands.

Fig. 2,
Is a section of the form of the ridges, water furrows, and cross grips or drains.



No stock should be suffered to graze on the seeds till they have got proper hold of the ground; when that happens, ewes and lambs and yearling beasts are the most proper stock for them the first year.

The art of increasing the quantity of leaves round the roots of young grasses, consists in eating off the central stems by sheep and cattle, early in the season; whence new grass leaves are produced around the first joint of the stem thus bitten off. From hence it is readily understood, why pastures, which are perpetually grazed, are so much thicker or closer crowded with grass roots, than those which are annually mowed. Hence the impropriety of mowing the grasses, the first, or even the second, third, or fourth year; especially upon this soil, which produces them very tardily. By the above management, the land will keep one-third more stock than it did before, for several years.

After a certain period of time the grasses degenerate, and the pasture returns to its original state. Hence the necessity of converting grass land into tillage, and of laying down such land with grass-seeds alternately.

Light Loam.

This is not only a pleasant working soil, but also moderately productive.

First Crop.

About the middle or latter end of February, plough the land in the manner expressed by fig. 1, and as the land is ploughed, sow five bushels of oats upon every acre, or drill four bushels; then harrow, water-furrow, and drain if necessary. As early in April as the season will permit, sow upon every acre fourteen pounds of red clover, and two pecks of rye-grass; then harrow the length way of the lands with a pair of light harrows, and roll them the cross way with a two-horse roller. Weed once or twice at the proper season, and afterwards reap the corn when ready. After harvest, eat down the stubble with sheep, but not too close, nor later than November.

Early in the April following, dress, clean, and roll the seeds as already directed. Mow the seeds only once, and eat the after-grass close down with sheep and beasts, till the middle of November, and then prepare the land for the

Third Crop.

Plough the ridges in the manner expressed by fig. 1; harrow it sufficiently, then drill upon every acre eight pecks of good wheat, and let the harrows pass once over it after; always remembering to lay winter cropping completely dry. The succeeding spring feed it down if too luxuriant, then harrow and roll it. The latter end of May breast or horse-hoe, and hand-weed, which operation should be repeated in the latter end of June. Then wait till the season for reaping.

Fourth, or Fallow Crop.

Early in November plough the land in the manner expressed by fig. 1. As this soil is peculiarly adapted to the production of carrots, potatoes, and turnips, the succeeding operations should be timed accordingly. If for carrots, ten or twelve tons of rotten dung should be laid on every acre previous to the first ploughing. Cross plough in February; plough it length ways in March; then harrow, and clear it of all weeds.

About the middle of April trench-plough twelve inches deep, and into ridges of twelve feet broad. Make it fine by harrowing and rolling, leaving it at last under the impression of the roller; mix five pounds of the red Dutch carrot-seed, among four pecks of dry saw dust, and four pecks of dry mould clear of dust for every acre; then drill it at twelve inches between the rows. Breast and hand-hoe them completely; and last of all hand-weed and thin them in the rows to the distance of four inches; if any more weeds appear, they must be pulled up by hand. October is the prime season for taking them up and securing them. After the carrots have been taken up, the land must be ploughed into proper ridges, and the seed sown upon the same ploughing.

This year I grew five acres of carrots, two acres and a half of which produced sixty tons, part of which I sold at four pounds per ton.

If for potatoes, the land should be cross ploughed in February, harrow and plough a third time in March. Early in April reduce the whole to a very fine tilth; clear it of couch-grass, &c. and then leave it under the impression of the roller. About the middle of April lay on every acre ten or twelve tons of long-dung; spread it, and with three ploughs begin to plant every third furrow of nine or ten inches broad. Rake the dung upon the potatoes, and then roll all down; horse and hand-hoe them properly as weeds arise; and let them be taken up and secured in October. Plough the land into proper ridges, as expressed by fig. 1, in which state it must lie during the winter months, until the April following, when the seeds should be sown upon the same ploughing.

If for turnips, the land should be cross ploughed in March. The latter end of April harrow it well, and then plough it the third time. The beginning of June reduce the whole into a very fine tilth, by harrowing and rolling. Clear it of couch-grass, &c; then lay on the auxiliary earths, or dung, in the following proportions per acre, *viz.* four chaldrons of lime, or eight chaldrons of chalk, or fifty tons of argillaceous marle, (when this earth is employed it should be laid on before the third ploughing,) or ten or twelve tons of rotten dung, or fifty tons of peat earth. The land should then be ploughed into ridges of twelve feet wide, in the manner expressed by fig. 1.

Harrow the ridges once or twice, and then roll them down; drill one pound and a half of the white topped turnip seed upon every acre, twelve inches distant in the rows, and half an inch deep, and afterwards bush-harrow the whole.

As soon as the turnips are got fairly in rough leaf, they should be harrowed the cross way of the rows, with a pair of light harrows, for the first hoeing. At the proper time they must be horse and hand-hoed completely. The time for eating them off, must depend upon the discretion of the agricultor. Early in the April following, the land must be prepared for the reception of the seeds. If the land has been under the carrot or potatoe culture, it will want no other preparation than harrowing twice, the cross way of the ridges, and rolling it once, and then to harrow it the length way once.

If the land has been under the turnip culture, it perhaps may want another ploughing, and the surface to be made very fine by harrowing and rolling, in order to make it fit for the reception of the grass-seeds, which should be of the following kinds and quantities to an acre.

Of Artificial Grass-seeds.

Cow clover - - -	4 pounds.
White ditto - - -	14 ditto.
Rib-grass - - -	6 ditto.
Trefoil - - -	4 ditto.

Of Natural Grass-seeds.

Sweet-scented vernal-grass - -	½ peck.
Smooth-stalked meadow-grass - -	1 ditto.
Sheeps fescue-grass - - -	½ ditto.
Meadow fescue-grass - - -	1 ditto.
Rye-grass - - - -	1 ditto.

No. VI.

Loam.—*By S. Deverall, Esq. Clifton, Nottinghamshire.*

Having a field of ten acres of my own in occupation, a loamy soil, worth 20*s.* per acre per annum, which had been in grass fifteen years, in 1793 I ploughed it up. I sowed Poland oats early, and had a fair crop, forty-eight bushels per acre, and after the oats had good stubble turnips, which were eaten on the land with sheep and beasts. In 1794 I fallowed and turniped it without either manure or lime, and had a fair crop, which was eaten on the land with sheep and beasts in March and April, the soil being too wet to eat earlier in the winter. In 1795, barley and grass-seeds were sown; the former yielded forty bushels per acre, and the seeds were good; the second year's seeds were manured with about its own produce, or ten loads per acre. This land has been grazed five years, and is one-fifth better for having been ploughed.

No. VII.

High Wolds.—*By Digby Legard, Esq. Ganton, near Malton.*

I beg leave to offer the following observations, as the result of actual experiment. I reside in the East Riding of Yorkshire, and occupy land of various sorts.

I have a tract of high wold land, uninclosed, with a shallow surface of soil upon a chalk rock, having been formerly exhausted by a system of tillage totally ruinous, *viz.* that of being sown with corn till it would not return the seed, and then being suffered to lie, without any grass-seeds sown on it, in the expectation that it may be covered with a little spontaneous herbage. In this neglected state it is not capable of maintaining more than one sheep per acre, and that only for the summer months. This soil varies in depth, being in some parts about four inches, in others extremely shallow. In the latter it is not practicable to pare and burn, and therefore I have

ploughed for and harrowed in gray peas, which I have found an excellent preparative for turnips, and have generally succeeded in having very good crops after them. These are eaten off by sheep. I have then sown oats, and have had from three to five quarters per acre. The oat stubble should be turned in, immediately after harvest, in order that the land may receive the advantage of a winter fallow (which cannot be too strongly recommended) and after working it well the spring following, it should be sown with rape and seeds; the rape to be eaten by sheep in the autumn, and as frequently as may be necessary, to prevent the stalks from flowering. The quantity of seeds sown per acre, is seven pounds of white clover, three and a half of rib-grass, the same of trefoil, and a bushel of ray-grass. After this course I have found the land capable of maintaining five sheep upon two acres, and for more months in the year, than it did in its former almost barren state, and likewise in keeping them in much better condition. Where this high-land is deeper in soil, and capable of being pared and burnt, that method ought to be pursued, as it insures a crop of turnips. And I strongly recommend that this be followed by another crop of turnips, and both to be eaten by sheep. I then sow oats, and the same quantity of seeds before mentioned. If the first crop of turnips be very luxuriant, and be followed by another of the same, it may be suspected that the oat crop will be so heavy as to destroy the seeds. This will rarely happen when the oats are sown sufficiently thin; but when I have been fearful least this should happen, I have sown oats after the first crop of turnips, and then after a winter-fallow, and thorough working in the spring, have sown it down with rape and seeds, the rape to be eaten in like manner as when the land was not pared and burnt. This course will pay the occupier most amply for his trouble and expence, without reckoning the improvement in his sheep-walk, which cannot be less than threefold; and I am persuaded that this is the only method of managing this kind of soil, so as to make it productive whilst in tillage, and to return it to grass in an improved state.

Sandy Loam.

The second sort of land on which I shall remark, is a sandy loam, capable of bearing every kind of grain. In this soil I have adopted the Norfolk five-shift husbandry, *viz.* old swarth broken up for wheat, after which turnips, barley, seeds two years (the first year summer eaten, and the second mown), and then again wheat. By adopting this course the land can never be exhausted, and, in a tolerable season, is

certain of producing a good crop. I have always found it best to manure well for the turnips, and have laid on between fifteen and twenty loads of old fold-yard dung per acre. But upon such soil, marle is the best of all manures, and if it can be had at a moderate distance, it ought to be used, because it strengthens a weak, restores an exhausted soil, and is a permanent advantage to the land. Upon a blowing sand I have laid on two hundred loads per acre. I must here observe, that in land on which turnips will grow, I never risk the taking of two white corn crops in succession; after marling however I adopt the following method. I lay the marle upon seeds of two years growth, which are ploughed out in the spring for oats, and on the oat stubble in the autumn I sow wheat after once ploughing. If the season has been tolerable, I have never failed of having a good crop of each. After the wheat I sow turnips, barley, red clover, and wheat again. In this mode four corn crops are obtained in six years, and the soil is not exhausted, but on the contrary made better for any succeeding crops, than it was before it was marled, which has always till this year been completed for less than four pounds per acre. It will in this year, owing to the increased expence of keeping horses, and the price of labour, perhaps cost five pounds. When I speak of loads, I mean not quite a ton, and two hundred of these loads will form a stratum of two inches in thickness. The first ploughing for oats should be as thin as possible; there should not be above an inch and a half of the swarth turned up. In this case the oats will grow freely, and when the stubble is ploughed for wheat, care should be taken to go deeper, that more of the original soil be turned upon the marle. The seed will then be harrowed into the old soil, and the roots will strike through that into the marle, which will be of sufficient strength to carry a great crop.

Low Bottoms.

The third and last kind of soil, which I have cultivated, is a tract of low land, a mixture of sand and clay, and till lately subject to be inundated. Embankments have been made, from which much benefit has arisen, and which enables me, although not in a degree so accurate as if the drainage had been perfect, to form an opinion of the most advantageous method to be adopted on these lands. All such when reclaimed from inundation ought to be immediately ploughed (and where there is depth sufficient it would be better to pare and burn them) notwithstanding that in particular summers they may have afforded abundant pasturage. The reason of

this opinion is, that frequent inundation produces aquatic grasses, which at times flourish vigorously, but will shortly perish, and die away at the root, when the nature of the soil is changed from wet to dry. It generally happens that such lands have never been ploughed. The most beneficial mode that I have tried, is to pare and burn for turnips to be eaten by sheep; then I sow oats, and afterwards lay on five chaldron of lime per acre, as a preparative for turnips to be eaten by sheep; after which I sow oats, and seeds in the quantity of sixteen pounds of white clover, five pounds of rib-grass, and a quarter of good hay-seeds per acre. The land so managed will carry considerably more stock than it did in its original state. If the drainage be complete, those seeds may be broken up at the end of two years (or as soon as they appear to decline in value), for wheat, and put into the four-shift husbandry, *viz*, turnips after wheat, to be succeeded by barley, clover, turnips and wheat again. Till the land grows tired with red clover, there cannot in my opinion be a more judicious mode adopted than the four-shift husbandry. When it is tired with red clover, which it will invariably be, after two successive rounds, either beans, peas, or seeds may be substituted. The two former are meliorating crops, and will be found advantageous on strong land, particularly, the former, where the land is not strong enough for beans. The best substitute for red clover is small seeds for two years, which throws it from the four into the five-shift husbandry.

No. VIII.

Dry Loam inclining to Sand.—*By Mr. Thomas Smith, of Chilnies, Oxfordshire.*

About the year 1790 I became the occupier of a farm, in which there was a piece of old land, and, to use the words of the late occupier, "the grass growing upon it, if touched, would cut your fingers."—But having from former experience found the benefit of ploughing old land for a time, as well as the improvement that might be made by it, I expected there to find a little treasure, and agreed, at the time of taking the farm, to have the liberty of ploughing this land for five years. In the spring following I began to break it up; but before I give you an account of my manner of cultivation, it may be most agreeable to have a description of the

land. It was a dry loam, rather inclining to sand; the late tenant represented it as barren and unfruitful, and, in short, of no value; the herbage growing on it only serving to impoverish the cattle. I was not however discouraged by his description; having a confidence in my own experience, I was led to believe it to be a piece of rich land, rendered useless through want of management. The grass, although keen, was but thin upon the surface, therefore I saw no necessity of paring and burning; but when I had ploughed it with my common ploughs about the depth of four inches, I sowed it with flax, and it bore a very good crop. I then, after two ploughings, with the third sowed it with wheat, the product of which was beyond my wishes, the burden being too great to be so productive as it otherwise would have been. I was therefore led to sow it again with wheat the third year, where it proved a better yielding crop than before, and only with the trouble of once ploughing. I then began to prepare my land for laying down, and in September following sowed it with winter vetches, and in February I laid upon them forty bushels of coal-ashes to every acre. This forced them on very fast, and on the eighth of May I began to put upon them my whole stock of sheep, and carried much away into the stable for the horses, keeping the sheep regular, by penning all the ground, and making the best of even the stumps, off which the horses' feed was cut. As I cleared the ground, I kept it covered with rotten dung prepared for that purpose, keeping a row of hurdles behind as well as before the sheep. I sowed it again the second time with vetches, which, with the assistance of another coat of ashes laid on them, as soon as they began to cover ground, in nine weeks I was enabled to put my stock a second time upon a good crop of vetches, which when eaten off, the land was richly prepared for sowing with turnips. This I did without delay, and raised as good a crop as any I had that year, the turnips growing to a fair size, and being remarkably productive of greens early in the spring. After this process I sowed it with oats, and laid it down again *much improved* with eight pounds of broad clover, four pounds of Dutch, and one bushel of ray-grass.

No. IX.

Peat.—*By Mr. Thomas Chatterton, of Whaplinton, near Pocklington.*

An experiment the writer will take the liberty to mention upon peat earth: a piece which he inclosed, containing about six acres, was for the greater part of the year covered with water, seldom more than a foot deep, and perhaps never dry, owing to the want of a level being brought to it from ditches at a distance below. When the level was brought up, it effectually drained it, though, from the retentive nature and springiness of the peat, it remained soft some years, insomuch that when it was pared, nothing but a long continued draught would prepare the sods for burning. It got, in consequence, but half a burning; it was ploughed up, and sown with rape and turnips, which were both very strong, and most of the large turnips carried off, the land being very unfit for cattle to lodge upon. Not being clean pulled or eaten up in winter, one part of it stood for seed the succeeding summer, which answered well. The other was sown with oats, which were a good crop. The year following, which was 1800, it was all well worked with several ploughings and harrowings, and sown with turnips and rape mixed. They were both strong and good, and about Michaelmas the rape was eat by lambs. At first, the peat was in most places ten or twelve inches thick, in some places much thicker, in others much shallower. When it was come into a mellow state, and much reduced in thickness by rotting, the peat was carried from the deep parts and spread upon weaker parts, and the whole ploughed deep, and mixed as much with sand as the plough could bring up, which was not so much as may be done another year, as it keeps sinking continually. It has not yet had any manure upon it, nor is it intended, so long as it will grow turnips, and the land gets into a firmer state. A pond was made in one part of it, where the peat was deepest, and the peat carried in to an adjacent field, the soil of which was a light sharp burning sand. It is now two years since it was spread upon it and ploughed in, and it seems to have answered well, but has been scarcely long enough precisely to ascertain the effect. From what the writer has ever seen of peat, which he has had a frequent opportunity of

observing, and many times during his life has had the working and using of it; as a manure, it is best spread upon, or mixed with either a clay or sandy soil, or mixed with lime as a compost; but he never found it a strong manure in any way of using. He has always considered it however as serviceable, and worth the expence, to carry it a moderate distance, and spread it thick upon any different soil, that is spent with the plough, or where dung cannot be had to cover weak grass land. The result of most of his experiments has been a freshness given to the land, without much additional weight of crop; it mended the quality of the grass and furnished the land with a different herbage. When the peat is deep, and strong or tough, he has always found that working it with the plough as often as convenient, sowing turnips, or rape, or setting cattle potatoes upon it; in short, making it a kind of garden, without the use of lime or dung, so long as it will bear a crop, answers best to the occupier, and in the end gives a firmness to the land, which otherwise it would not have had. Where the land has not too cold or wet a sub-soil, lime answers well upon it, in any stage of the business.

No. X.

PEAT.—*By Mr. John Ambrose, of Copford, near Colchester.*

ON the decease of an uncle, his residence and farm, of upwards of 200 acres of land, came into my possession in the year 1784. Entering on the farm, I found a poor man there of good character, industrious, and honest, with a wife, and a family of eight children, who occupied two acres of garden-ground. He solicited me for a piece more of ground; I let him three acres of sedgy bottom, at a very low rent for ten years, which was the extent of my term. He cut a deep grip up in the middle, and of a proper width, stubbed the sedges and mowed the weeds, and burnt most of them, hollow-drained every four or five yards very deep, to cut through the springs, filled the ditch up with picked stones, on which he put some of the sedges, and then some of the soil. The next spring he dug and planted it with cabbages, potatoes, savoys, &c. &c. and soon got it all dunged over, for which

purpose he used to keep a cart and two asses. The potatoes, savoys, turnips, cabbages, carrots, and garden stuff in general, were excellent. He brought up his family without any parochial assistance; and by his industry and regular living, bought the house he lived in, at near a hundred pounds. He was a good tenant, and paid very well; he and his family always looked clean and very decent. I asked him one day, how he managed to get on so well in maintaining and cloathing himself and family, &c. &c. and paying for the house which he had purchased. "Why sir," says he, "I eat only when I am hungry, and drink when I am dry; all my family do the same; milk and Adam's ale;" and that he thought threepence for a pint of beer was too much for a working man like him to give. At the end of his term he purchased a good team of eight horses, a broad wheel-waggon, and a timber carriage; the former to cart malt, coals, cinders, &c. twelve miles from one seaport, and fifteen from another; and the timber carriage he used to cart timber, when not fully employed with his waggon; the three acres of land are now laid down for pasture, and are worth 50*s.* per acre per annum, which were not worth one, when he took them. After seeing that the three acres were likely to do so well, which I let to Thomas Hodges (for that was his name), having two acres more of the same sort of soil at eleven miles distant, all over-run with very thick broad leaved segs; in the spring 1786 I cut a grip six feet deep through the middle of it, and land-ditched it, filled it up the same as Thomas Hodges, five yards apart, and five feet deep, and mowed the segs when I land-ditched it. The spring following I ploughed it six inches deep, as it had got dry enough to bear the horses; harrowed it three or four times, and got it pretty clean, then sowed it with two bushels of oats per acre, twenty-four bushels of hay-seeds, and 10lbs. of white Dutch clover, and was lucky enough to get three quarters of oats per acre, and a good plant of grass, which was my object. I have mown it once a year ever since, and afterwards feed it off with my sheep and bullocks. This land now is worth 40*s.* per acre, which before was of no use, but to harbour foxes. In the spring 1781 I found on the farm I now live in, a piece of ground called the Six-acre Moor, very unlevel, for the water to get off, and very full of rushes. It was neither very light, nor very heavy land; the soil a black sandy loam; I ploughed it up about four inches deep, and planted it with tick beans; had a very great crop of straw; but unfortunately the black insect (or louse) took them as they went into the blow; I therefore got but about twenty bushels of beans per acre; as soon as the beans were off, I ploughed

it up six inches deep, and gave it three clean tilths and a half, and sowed it with wheat; had three quarters per acre; after the wheat I gave it a clean summer fallow for turnips, barley, and grass-seeds; ploughed it five times, and gave it as many harrowings, rollings, and water-falled it, and dunged it with fourteen loads of mixed dung and earth, to the acre. This was all done before the turnips; I had very fine turnips, fed off with sheep on the land. In the spring, on once ploughing, two bushels per acre of barley and 10lbs. of white Dutch clover-seed, and twenty-four bushels of hay-seeds, off a particular field, containing a good deal of the meadow-foxtail, and meadow-fescue, were sown; the seed planted well, and the barley, to my astonishment, was very strong indeed, three large waggon loads an acre; but when thrashed, five quarters per acre only. I mowed the grass the next year, and rather late, that some of the forward grass-seeds might thicken the plant; and I am sure I had forty hundred an acre of hay. It is now down as a meadow. Since the above, I broke up of old pasture two more pieces, of three, and eight acres each; I have managed them in the same manner as the six acres, with this difference, that I sowed with oats instead of beans first, and the eight acre piece I laid down at the Midsummer, with white clover and hay-seeds, without sowing any corn with it, instead of sowing it with turnips and barley, as I did the other; and both those two last mentioned pieces did likewise very well indeed. The lord of this manor I have advised (and the advice he has adopted) to lay down his layers at Midsummer, and they do exceeding well;* but rye-grass, with white Dutch clover, on very light sandy lands, for one, two, or three years, do better, and are generally more productive than most other sorts of grass-seeds.

Sandy Heath.

With respect to warren and heath land, in the year 1794, I had twenty acres of warren heath allotted to me, being a part of 300 acres of new inclosure. It was called the warren part of the heath, and had not apparently been broke up since Noah's flood. There was a little poor and bad sort of grass growing upon it, but mostly covered with ling or heath, some brakes, a little furze, and white thorn stubbs. I thought it might do to shift my South Down wether lambs upon it. I tried with them for nearly two years, and it did me but little good. I was determined to set on

* Several pieces in his park he has laid down at several different times, and they do very well indeed; much better than before he broke them up.

fire in the summer of 1796, and burn the ling up, it was so thick; and when very dry, by the assistance of the brakes, it burned very clean, and at little expence. It cost me three shillings an acre only, levelling the hills, stubbing the few furze and white thorn roots. It was thus made quite fit for the plough. I then ploughed it about four inches deep. At Michaelmas 1796 I sowed it with rye, two bushels and one peck per acre, to stand for seed. I had, thrashed and dressed, rather better than forty quarters of it. I then ploughed the rye stubble in quite flat, that it might rot the better in autumn, and then in the next spring I gave it three more close and deep ploughings, and sowed it with black oats, white Dutch clover, and rye grass. I had eight quarters thrashed and dressed, and a great deal of good feed for my sheep and lambs the next summer, and they did very well upon it. In the autumn and winter, I manured it with dung and fresh earth mixed together, twice stirred over. I laid on twenty three-horse cart-loads per acre. The Michaelmas 1799, I ploughed it up, and drilled in six pecks an acre of American red wheat, and have had, thrashed and dressed, from off the twenty acres, fifty quarters of as good wheat as ever I saw. I ploughed the wheat stubble in again last Michaelmas, and sowed it with rye, and now have as fine a plant as I can wish to see. I designed to have fed this off with my sheep this spring, and have fallowed it for turnips, but the price which rye bears will induce me to save it for seed. The soil of these twenty acres of warren heath is black, light, and sandy. It was scarcely worth any thing before it was broken up, and now, to let, it is well worth twenty shillings per acre per annum.

Waste Sand.

Before the writer entered upon his farm, he was at the expence of sinking a well near fourteen yards deep, partly for the convenience of good water, and partly for the knowledge of the *strata* of earth. From the surface to about the depth of ten feet, was sand full of water, which was a convincing proof something more firm than sand was beneath, which proved to be about ten yards in marle, where a vein of stone below the marle resisted the sinking tools, which, together with the great flow of water, prevented any deeper search being made. Soon after this experiment was made, at a distance from the well, a large square pit was sunk, until the stratum of marle was laid bare, during which time a pump was going day and night to keep the water down, which afterwards filled the pit nearly to the surface. No marle therefore could be got, until a drain was brought up from a great distance, and in

many places at a great depth. During the time of doing this, a better method of improvement than that of marling was discovered, as it was done at little or no expence, therefore the marle was not then searched after, nor has it been since.

The method was this—to break up the grass land, though it was but weak, and very foul with twitch or quicks, yet if it had been laid four or five years, would bring a middling crop of oats, and the following year a crop of turnips, without the assistance of any manure. Eating off the turnips with sheep furnished the land with sufficient strength to bring a good crop of oats, together with grass-seeds, which when done, the land was left in a cleaner, stronger, and much better state than it was found at first, having had at the same time two crops of oats taken from it;—but to the particular experiments.

In the year 1789, a piece of land, about twelve acres, entirely covered with ling and furze, was pared and burnt late in the summer, ploughed in the latter end of the year, and sown with rape and rye, as winter feed for sheep; this was done at the landlord's expence. The spring following the tenant, instead of working it over for a crop of oats or turnips, let the rye stand for a crop, except a few lands on one side the close, which he ploughed and sowed with oats and seeds; the other part also was sown with grass-seeds. Though in a very rough state, as may be imagined; this rough part had a thin scattering of lime upon it (the expence to the landlord, for paring, burning, ploughing, lime, grass-seeds, &c. amounted £28.), the quantity of grass-seeds sown cannot now be ascertained; the crops of corn were but small, but the grass-seeds much better than could be expected.

This piece of land lay in grass three years, during which time it was pastured; when the ling and furze began to appear again, it was then ploughed up to the depth of eight inches or upwards, and produced a very fine crop of good oats, except upon the tops of the lands, which had been much thrown down by the plough. To level them the following year, the piece was sown with turnips, and a little rape scattered in some places; the piece being partly dry land and partly moist, both sorts succeeded well; the turnips were very large in general, and the rape strong, except upon those parts which were made poor by throwing down; upon these a light scattering of dung was laid, but little benefit accrued from it; the turnips and rape were chiefly eaten by sheep; and the following spring, oats, and a mixture of grass-seeds, were sown, about 3lbs. of red clover, 3lbs. of white clover, 3lbs. of trefoil, and 3lbs of rib-grass, with about a peck of rye-grass, upon each acre (but

since that time it has been found advantageous to sow more). The piece has been pastured with sheep and cattle, and has continued to improve every year, and now carries a very good stock, and feeds good beef. Should it now be ploughed up, there is not a doubt but it would produce either a strong crop of rye or oats, and either one or two crops of turnips, as might be found expedient. If the turf was not sufficiently decayed with one crop of turnips, or it was judged would not be so, with the succeeding crop of corn, then it would be advisable to sow turnips a second time, which would still add strength to the land, and produce better crops of every kind in future. The next step must be, to sow oats with the following seeds: red clover, 4lbs. white clover, 3lbs. trefoil 4lbs. rib-grass, 6lbs. carraway, 2lbs. and rye-grass two pecks, upon each acre. This produce is raised without manure, and the land is at the same time much increased in value; but care must be taken not to destroy the turf by the plough, as the seedling plants would be deprived of their principal support.

The writer has very successfully sown the grass-seeds upon dry sand with rye, after a crop of ox-noble potatoes, which were manured with about six loads of light dung upon an acre, and put into the trenches with the potatoes when set. As soon as the potatoes were taken up, the rye and grass-seeds were sown in the month of November, and harrowed in with one ploughing; but previous to the potatoe crop, the land had been pared and burnt, being full of ling, and a partial crop of turnips upon it, the summer before potatoes. The turnips were in some parts good, but in most places of little value;—a very common thing on such lands. This is only mentioned as an imperfect experiment, not being yet finished; but should a general inclosure of wastes take place, it may furnish a useful hint to some of the persons interested.

In the year 1795, a piece of land, about thirteen acres, was broken up, which had been ploughed as long as it could carry a crop, and left, about five years previous to that time, very foul with twitch or quicks, and without any grass-seeds sown upon it; it swarded as it could, and whatever came was eaten off by cattle straying over it. In the course of the above mentioned five years, it had formed a sward of some strength, chiefly twitch, but was in so poor a condition, that it produced very little feed, and that of a very ordinary quality. Seeing it very full of white speary twitch roots, it was thought proper to try if, by reducing the sward into manure, it could not be made capable of bearing crops without the help of other manure, which

could not conveniently be procured. Accordingly it was ploughed eight or nine inches deep, perhaps ten inches in some places, and four bushels of Poland oats were sown upon an acre. The season was favourable; the oats were sown the latter end of February and beginning of March, the land well harrowed to cover the seed deep as could be, and the produce at harvest was judged to be six quarters upon an acre on most of the field, but less upon other parts, according to the difference of the soil; perhaps five quarters upon an acre was as near the average quantity as could be estimated. The quality was excellent, superior to any that was got that year in that neighbourhood, and fetched the best price in the market. They weighed near twenty-nine stone per quarter, one pint over Winchester measure, a weight not known before in the neighbourhood; the farmers around were astonished, and wanted to know the cause; but no other reason could be given, but the ploughing twice as deep as they did, and sowing five or six weeks sooner. These oats were well rooted, and got great part of their feed before theirs were up; the consequence was, that a little hot weather did not affect them, and they were early ripe. The following spring the field was prepared to be sown with turnips, for which purpose the land was ploughed in the same way as it had been for the oats, but half that depth, for the following reasons;—by so doing, the furrow was divided, and would separate with more ease in harrowing, and also but a part of the twitch roots only would be in work at one time, which gave a better opportunity of killing it before it was turned under furrow again; the second ploughing was to the depth it was first broken up. The twitch roots were so abundant on the second ploughing, that the field resembled a hay field more than a fallow, and when ploughed a third time, a person was obliged to follow the plough to put the rubbish (which was effectually hilled) into the furrows with a fork. After this, turnips were sown, and became at the season a very full good crop, except on the ridges of a few lands which had been thrown down to level the land (an operation inconvenient for the present, and though necessary, many years elapse before the lowered parts are so good as the rest). The succeeding winter was very severe, and after sheep were put upon the turnips, they had not eaten more than three or four acres, before the frost destroyed most of the remaining part; when the sheep were let into the whole field to pick up the few that were not destroyed, so that little manure was produced by the sheep; yet rotten turnips proved a sufficient manuring to produce a very good crop of oats in the following year. It was estimated at seven quarters per acre, but could not be

exactly ascertained, as both the straw and corn were of necessity used in various ways. The oats, which were of very superior quality, weighed, with the sacks, twenty-nine stone ten pounds per quarter, a weight of which the writer never heard before, and for which he could not assign any other reason than the ploughing deep and sowing early. Shallow ploughing has been much in use of late years, and several false reasons have been used to support it, but whoever tries the other method, will find the present and future advantages of it, by giving the different vegetables more opportunity of extending their roots, and thereby gathering more nourishment than can possibly be gathered from hard unmoved soil. The roots that are most distant from the surface are least liable to be injured by excessive heat, as being nearer to moisture. The seeds sown with the oats were nearly as follows; red clover, 2lbs. white clover, 3lbs. rib-grass 4lbs. and rye-grass two pecks upon each acre, and carraway one stone upon the whole field. The season was very favourable for the seeds as well as the oats; they planted very well, and flourished through the summer; the spring following they appeared early, and were eaten chiefly with sheep, as they were the succeeding summer, and kept a great stock. In the year 1800 it was mowed, the writer having intended to keep it perpetually for mowing, when he could cleanse it from all pernicious weeds. Having fully accomplished that point, it had about thirty loads of dung thinly scattered upon the weakest parts of it early in the winter; and though the winter and spring were harsh, there was good food for ewes and lambs as soon as the sheep began to yean; it was eaten until about new May-day, and mowed in July; about twenty tons of excellent hay was the produce; a better crop than in the neighbourhood was afforded from land of the first quality, and earlier sown. Having related the whole management of this piece five years back, the writer will now give as full a description of the nature of the soil as he is able, and add something on the use of the carraway plant, as he is of opinion it is of new introduction amongst grass-seeds. The above mentioned piece of land is all sand, but not exactly of the same kind; the greater part of it is a mellow brown sand, but some of the highest parts are of a sharper nature than the rest, consisting of a hard iron sand within reach of the plough, and the lowest parts more black and soily; the worst of it is better than many other parts of the farm at present, but may not be really so in its nature, as very bad looking sand by working becomes much better, and puts on a different appearance, and yields also a larger produce. The above mentioned land was formerly part of

a corn field, and had been perpetually under the plough, but forty years ago it was inclosed, though perhaps not very differently managed afterwards, until within the last ten or twelve years.

In the year 1796, a field of about thirty-three acres was broken up, which had been laid in grass ten or twelve years; the whole of it was sand, but more various in quality than either of the two beforementioned fields; the greatest part of it was of a dry yellowish-brown sand, very subject to scorch, and blow away with high winds; another part was more solid and better sand, of a darker colour, and of more strength. It lay lower and was somewhat more moist; another part, about five or six acres, was covered chiefly with rushes, and what is here called "bent," but may be properly called a dwarf rush, growing in bunches like chives. This part ought to have undergone a course of husbandry different from the other, but as it could not be conveniently taken from the rest, it was therefore obliged to be worked with it. The part where rushes grew was very wet previous to its being broken up: an under drain was brought up from an open drain at a distance, and having neither stone nor wood upon the land, was obliged to be made in the following manner. The drain was set out three feet wide at top, the sward cut into four sods of nine inches each and placed on one side the drain, and the earth thrown out on the other side. When the drain is made deep enough, which should not be less than three feet, if the fall will allow it, two walls are to be built in the bottom of the drain of the sods first taken off the surface, they will be in this case two sods high, and to form a hollow drain must be placed within two or three inches of each other, then neatly pared on the inside, not to greater width than four inches, but less is better; the wider they are the weaker. This being done, a sod is taken from the side of the drain, cut large and thick, and laid with the grass downwards, as a cover to the sough; the sand is then put in again: the whole business cost from eight-pence to one shilling per rood of seven yards. When done, it effectually answered the purpose, and continues so to do; the writer has had occasion to drain a great part of the farm by the same method, which answers every where, except where there is boiling quicksands; to remedy which, he has at present found out no better method of preventing the sough being choked by sand, than by laying wooden pipes, either of four boards nailed together, or old pump trees, over those quick sands where the sand boils up. The reason of the above drains being made in the manner described, is the sand being so soft and loose, the sides will not stand the common methods of

sod soughing. Within the course of last month, it was necessary to cross one of these drains by a ditch; the sough had been made about seven years, it was perfectly firm and open, and promises a durability without end.

Nothing but the Honorable Board's desire of minute description can apologize for this long discussion; but to return. The field was all ploughed to the depth of nine or ten inches, partly before Christmas, the rest after, and sown in the spring 1796. The dry parts were sown about the 20th of February, rather more than four bushels of Poland oats per acre; they were above ground the 25th of March, and were a very good crop of excellent quality, not very thick upon the ground, but strong straw and large ears, which may possibly be one reason of their weighing so well; at least the writer thinking so, has always been induced not to sow too much seed, as the less straw is grown, the less is the land exhausted, and the grain bolder; but he only gives this as his opinion, not as certain, though a long practice has confirmed him in it. The same method was pursued with this field as with those broke up in 1795; the turnips were so good, that they were let to be eaten with sheep at three guineas and a half per acre, except the wet or rushy part, which could not get a sufficient working to be properly prepared for turnips. They were large, but thin on the ground, and the occupier eat them with his own sheep. In the year 1798 it was sown with oats and grass-seeds, but the business was very improperly done, which was unavoidable, as either the dry part must be worked a year too long, *viz.* till the turf was destroyed, or the moister part must want a years working to bring it into a proper state to sow down with seeds. It ought perhaps to have had another crop of turnips upon it; but having seen the great disadvantage of working tender land too long before seeding with grass, it was thought best to suit the dry and tender part, and let the other take its chance. Unfortunately after the oats and grass-seeds were up, there happened three weeks of very scorching weather in May, and the beginning of June, which burnt up most of the seeds on the dry land, and greatly injured the oats; the moist parts being unfit for seeds, were excessively full of weeds, particularly the willow weed. The oats however being strong and vigorous, kept above the weed, and received but little injury, whilst the grass was much hurt and destroyed. Upon the whole, the crop of oats wss less than the former crop; the seeds very thin and poor, which caused it to carry a very light stock the year following; yet the last year it has done much better.

I must beg leave to relate a circumstance which may be of service to the public. When the weedy part of the oats was thrashed, a prodigious quantity of small seeds dropt through the screen, in the whole about fifteen quarters; finding them heavy in hand, I was confident that they must contain nourishment for cattle, yet if they were given whole, the cattle could not grind them (from their smallness); the consequence would be, they would pass through them whole, and be carried into the field again with the dung. They were therefore sent to the mill to be crushed, and given to cattle as corn, with oat-straw, and about fifty bushels of potatoes. They fed four cows which cost £26. and were sold for sixty guineas, besides supporting and rearing calves, one foal, and two milking cows. The miller had one shilling per quarter for grinding: this must be better than throwing the seeds into the highway, which many of my neighbours did. I have dwelt longer on the management of this field than I otherwise should have done, to show, that the best plans and rules have exceptions, and that seasons and circumstances will frustrate the best management. Had this field been broken up a year sooner, most probably it would have put £150. more into the occupier's pocket, and have been this day in much better condition than it is. I must not omit to mention, that 4lbs. of carraway-seeds per acre, were sown here, and about 12lbs. of mixt seeds, red clover, white clover, rib-grass, and trefoil, with two pecks of rye-grass, and that more of the carraway appeared in 1799, than of all the others put together; in the year 1800 they failed, as before described.

The writer could detail experiments in many other fields, but the variations from what he has described are so few, that it would be tedious to represent them. He prefers two crops of turnips to one, when the turf is strong enough to admit of it, as by this means the land gets an additional manuring when the crop is eaten by sheep, and not drawn off. He has repeatedly proved it to be a very hazardous and unsafe method totally to destroy the turf or sward of tender land, whether it be sand or a mixed soil, before it is restored to grass again. It subjects the seeds both of grass and corn to be laid bare by the wind, which is ruin both to the present and future crops. It leaves the land in too dead a state of vegetation; and though it may not be so much perceived the first year, the succeeding ones will show it. On the contrary, when land is left full of small knobs of indigested sward (if that expression may be used), they continue to ferment, and by that means keep the earth light, giving opportunity to the roots of plants to strike deep and thick, and to collect

nourishment to the increase of strength; it also leaves the land in good condition; and when the time arrives, which should not be at less distance than four years, but rather five or six before the breaking up again, it will be found rich, provided it has been pastured all the time with sheep or mixed stock, or if mowed (which cannot always be avoided), has got a proper dressing with good dung.

No. XI.

Salt Marsh.—*By Mr. William Curtis, of Lynn, Norfolk.*

I had a neighbour who, by embankment, converted, about four hundred acres of salt marsh into a more profitable course. After the sea was excluded from its accustomed depredations, the land was immediately ploughed up and sown with oats, but scarcely a single grain was seen to vegetate. In the same summer it was afterwards sown with cole seed; but here one disappointment trod on the heels of another, though rather in a less degree; particular spots here and there produced a very decent crop, but the quantity was insufficient to defray the expence. In the month of August following, the whole of it was again sown with the same seed. This second crop, in a great measure, not only compensated for the former failures, but was a happy presage of ensuing profit. In the following autumn, after this crop was reaped, the whole of the land was sown with wheat, and in the ensuing spring, when it might be about four inches high, it was all laid down with grass-seeds; but whether the defect proceeded from the greatness of the crop, or from the seeds themselves falling into the interstices of the grass of the wheat, which prevented its arrival at the soil, cannot now be known; it is only certain that scarcely one-fourth of the land proved fit for pasturage. That portion of it was, and continues, extremely fine, but the other has ever since been coarse and unproductive. The proprietor being an old man, with a tolerable share of the characteristic obstinacy of declining life, has ever since (a period of about eighteen years) consigned its produce solely to nature's operations. It has constantly been fed with sheep and bullocks, and from the fine and prolific state of that portion that succeeded, there is not the

slighest doubt, but that the whole might be converted into the best of pasture. It has lately become the property of another, who will probably profit by the errors of his predecessor. The soil is a silt; and the grass-seeds with which it was sown, were a composition of hay-seeds, cow-grass, narrow-leafed plantain, and white clover. When land is fresh recovered from the sea, I conceive (provided flooding is not practicable) that it ought to remain a whole year before it is consigned to tillage; as it will take that period, at least, to expel the salts sufficiently for corn to vegetate. I knew a gentleman who sowed a piece of arable land with turnips, and in the ploughing, preceding the sowing of the seed, he dressed the land with refuse salt. The consequence was, that on thirty-six acres of land he had not twenty turnips, though the same seed sown on the rest of the farm evinced not the smallest failure.

No. XII.

WOODLANDS.—*By Mr. Thomas Cussans, of Bedhampton Park, Portsmouth.*

I CONVERTED twenty acres of wood-lands into pasture, by cutting the principal part of the timber, except some young plants, that are of service for sheltering cattle. The underwood not being thick enough for a copse, I had it grubbed, but broke the ground as little as possible. I fed it with sheep and beasts, and in the winter hayed the sheep; owing to my keeping a great stock, it is now getting to good pasture or grass land, without sowing any seed. The reason I broke the ground as little as possible was, because the surface of the land is much better than the mould lower down, owing to the dead wood and leaves rotting time out of mind on the surface. It fatted five beasts last summer, and has been grubbed only three years.

No. XIII.

Waste Heath.—*By Mr. C. Ritchie, of Culmore, by Stramaur.*

I shall offer some hints respecting the improvement of certain smaller portions of coarse unimproved lands, occupied by tenants who hold leases thereon of nineteen years and under, and who either from a want of means or inclination, permit all of which to be in the original state, *viz.* quite barren.

As the expence of lime is the principal charge in improving all such lands, I would request the proprietor to advance the amount to the tenant, interest free for three years; the proprietor to be reimbursed at the end of that period; the tenant in return to be bound not only to improve on a plan to be laid down by the proprietor, but also to be subjected to a certain mode of cropping, after the improvement is effected.

Many thousands of acres of land of this description come within the sphere of my knowledge, worth from 1*s.* to 9*s.* per acre;—the average of which is 5*s.* per acre in its present unimproved state. Suppose I lay before your Lordship an experiment made in the improvement of a small field of very coarse land, in its original state, not worth the average rent above stated. It was summer-fallowed, and limed, under every possible disadvantage with regard to economy in the expence. As both the outlays and returns shall be given in one general point of view, your Lordship will be able to judge how far my scheme is worthy of notice, or whether the improvement be worth the expence, the experiment proved, or the permanent improved or advanced, value of the land being ascertained.

Expences incurred on the Improvement of five Acres of coarse Heath Land, with the Outlays and Returns of the four succeeding Crops.

To ploughing 5 acres four times over, at £3. per acre	£15	0
To harrowing ditto, and gathering and burning the heath roots, &c. - - - - -	5	0
To liming at £5. per acre - - - -	25	0
Carried forward	£45	0

	Brought forward	£45 0	£. s. d.
To 35 bushels seed-oats, 3*s.*		5 5	
To 2 years rent, at 5*s.*		2 10	
To interest of money, before any return		2 15	
To reaping in, gathering, and other incidental charges on the sale of the crop		5 0	
Outlay before a crop		£60 10	
	First Crop's produce.		
By 220 bushels oats, at 2*s.* 10*d.*			31 3 4
	To total outlay before a crop	£60 10	
By the return of first crop			31 3 4
	Expences incurred on Second Crop.		
To 150 loads of dung at 1*s.* 6*d.*		11 5	
To 3 ploughings, and harrowing,		10 0	
To 100 bushels seed potatoes,		5 0	
To cutting, planting, and horse-hoeing		5 0	
To rent		1 5	
To raising the crop, and other incidental charges		11 5	
Outlay on 1st and 2d crops		£104 5	
	Second Crop's produce.		
By 1600 bushels potatoes at 1*s.*			80 0 0
	Expences incurred on Third Crop.		
To ploughing and harrowing for bear or big		3 15	
To seed 22 bushels, 3*s.* 6*d.*		3 17	
To 10 bushels, rye-grass-seed, and 50lbs. clover ditto,		3 15	
To rent and other expence		6 5	
To total expence incurred on the 3 crops		£121 17	
By total produce of 2 crops			111 3 4
	Third Crop's produce.		
By 180 bushels of big or bear, 4*s.*			36 0 0
	Total produce	£147 3	4
	Total expence	121 17	0
Balance in favour of improvement		£25 6	4

Brought forward		£25	6 4

Here we state the Fourth Crop.

By 520 stones of hay, 26lbs. per stone, 1*s.* - -	£26 0		
Expence of mowing, making, &c. - - -	1 10		
		24	10 0
By hay stubble, or after growth - - - - -		2	12 6
		£52	8 10

By this statement your Lordship will see £52. 8*s.* 10*d.* of clear profit on the improvement, besides a moral certainty of this small field continuing worth 15*s.* per acre in pasture, being triple its original value. But admitting, that from local situation, the produce of this spot has sold high, (which, by the way, in these times is hardly stated at half its value,) but even though there had been no saving, the improvement was an object worthy of attention both to proprietor and tenant. Having given ocular demonstration of the truth of this observation with regard to the latter, let us enquire how far the proprietor has reason to expect to be re-imbursed the loss of interest on the three years loan of £25.; the accumulated interest of which, for that period, amounts to £3. 18*s.* 9$\frac{1}{2}$*d*; and this sum accumulating for the space of ten years more, which we shall suppose to be the medium of duration of all the present let tacks on such lands, will extend to the sum of £6. 8*s.* 7$\frac{1}{2}$*d.* now, reckoning this field to let at 15*s.* per acre on a new lease, the proprietor will receive £45. per cent for such outlay. Thus it will appear obvious that a process of this nature, and carried on to a considerable extent, will turn out far more lucrative to the proprietor than a *new purchase*, a much greater national benefit, and a very great *stimulus* to improvement

No. XIV.

PEAT.—*By Mr. R. Hay, of Netherplace, by Glasgow.*

IN 1790, a piece of ground fell into my possession, two acres and a half of which were lying in their original state; the soil was peat, intermixed with a little black loam. There were some springs of water that rose upon the highest part of said piece of ground, which being all nearly upon a level, the spring had continued always to extend over the surface of the whole piece of ground; and what vegetation was produced was nothing but moss, with a little star-grass.—In the months of November and December I had it all digged with the spade, formed into ridges of six yards broad, leaving an open drain betwixt each ridge for taking off the water. Without any manure whatever I cropped it with oats in March following. Its produce was six bolls per acre, being six times the quantity of seed. Being convinced that much more might be done for it, as soon as the crop was taken off, which was in September 1791, I had it all dug over again, throwing four of the former ridges into one lot, leaving an open drain four feet wide at top, two at bottom, and two and a half deep, so as to draw off the stagnant water that was lodged in the soil with the earth that came from these drains. When digging, I raised the middle a foot and a half higher than the sides, so that there was a good deal of declivity towards the main drains, which tended to make the soil completely dry.

Immediately after having it thus laid out, I caused to be layed four chaldrons or two pounds worth of lime per acre; In March I added of stable dung fifteen cart-loads, in value £ 1. 10*s.* per acre, and seeded it with oats. It being too soft to carry horses for the covering of the seed, I caused it to be hoed all over with hand-hoes, to the depth of perhaps two inches.

I then seeded it with grass-seeds of the foxtail kind, and had it well rolled. My corn crop was sixteen bolls per acre, an unheard of crop in this part of the country to be produced from any ground. From the strength of the oats the grass-seeds seemed to be much impaired, but I immediately sowed those places that had lost

root, and the following crop produced four hundred stones per acre, from weight, being nearly one hundred more than ever I knew on any other piece of ground. The piece has since been partly employed as bleaching-ground. Though more than the half of it has been twice in crop, the produce has not been less than ten bolls per acre; and when in grass, it produces more than what it had done formerly in tillage. I have the stems of the produce of one corn still by me, that produced upwards of 4000 fold, as did many others which came to perfection, besides a great many that produced only chaff; from the one corn there were forty stalks, thirty-seven of which still adhere to the roots. If your Lordship or the Board has a wish to see it, it is much at your service.

I shall now state to your Lordship the expence of improvement, and the value of these three crops.

Expence on Crop 1791.

Digging $2\frac{1}{2}$ acres, at 30*s.* per acre.	3	15	0
Seed corn $2\frac{1}{2}$ bolls, at 16*s.*	2	0	0
Reaping ditto, 6*s.*	0	15	0
Ground rent 40*s.*	5	0	0
	£11	10	0

Expence on Crop 1792.

Digging, with levelling and draining, 65*s.* per acre.	£8	2	6
Liming at 40*s.* ditto,	5	0	0
Dunging at 30*s.* ditto,	3	15	0
Seed $2\frac{1}{2}$ bolls, at 18*s.* ditto,	2	5	0
Hoeing and rolling 7*s.* ditto,	0	17	6
Reaping 20*s.*	2	10	0
Rent 40*s.* ditto,	5	0	0
	£27	19	6

Expence on Crop 1793.

Grass-seeds per acre 10*s.*	£1	5	0
Making hay per acre 20*s.*	2	10	0
Rent per acre 40*s.*	5	0	0
	£8	15	0

Expence on $2\frac{1}{2}$ acres for 3 crops, *viz.* 1791 - - -	£11	10	0
1792 - - -	27	10	6
1793 - - -	8	15	0
Total	£47	15	6

First crop in 1791, 6 bolls per acre, with straw, worth 12*s.* -	£15	15	0
Second ditto, 1792, $16\frac{1}{2}$ ditto, ditto, ditto, ditto, 25*s.* -	51	11	3
Third ditto, 1793, $2\frac{1}{2}$ acres hay, weighing 400 stones at 6*s.* -	25	0	0
Value of the three crops	£92	6	3
Expences incurred on three ditto,	47	15	0
Balance	£44	11	3

The profit upon the two acres and a half was of the amount above stated, and I look upon the ground in all time coming, to be as valuable as the best loam soil in the country; for though the bottom is still too soft to be ploughed, yet it amply rewards the expence of digging with the spade.

No. XV.

SAND.—*By S. Deveral, Esq. of Clifton, Nottinghamshire.*

I HAVE in my occupation under lease, a field of eight acres of good sand land, worth 24*s.* per acre per annnum, which had been in grass fifty years, and was deemed by many not worth ploughing. In 1785, I, by permission of the agent, ploughed it up to take some crops, and return it to grass after one fallow. I first sowed it with Poland oats, and had fifty-six bushels (Winchester) per acre; these were cut early, and brush or stubble turnips sown, which were good, and eaten on the land by both sheep and beasts, until the first of May 1787, when I sowed barley, which proved likewise good, producing forty-eight bushels (Winchester) per acre. In 1788, finding the turf not sufficiently reduced, I again sowed Poland oats early, and I had a crop equal to the first, and again good stubble turnips. In 1789 I fallowed and manured with fifteen three-horse cart-loads of manure, and ten quarters of lime per acre; the turnips were unusually good, and fed on the land. In 1790, I sowed barley and grass-seeds; the barley was good, yielding fifty-six bushels per acre. This land has been in grass ever since, and is much improved by ploughing.

No. XV.

FENS.—*By Mr. John White, of Wykeham, near Spalding.*

IN the neighbourhood where I reside, in the fertile level of Lincolnshire, the plan of converting certain portions of grass land into tillage is certainly a most desirable one, where above one half of the land now in pasture absolutely requires ploughing to make it in a better state than that in which it now is:—I mean, thousands of acres which have never been ploughed for centuries back, and perhaps that never were ploughed at all, particularly where the inundated state of the country in former times would not admit of it, but which is now greatly improved by drainage. This description of land is generally used as meadow, but if it was in tillage for a few years, the straw that it would produce would keep as much young stock in the winter, and be nearly of equal value with the quantity of hay it now produces. The eddishes upon those lands are for the most part weak and husky, and of course not of any feeding quality. About ten years since, I obtained leave of my landlord's agent to break up eight acres of this kind of land, which lay (as we term it) neither high nor low. Sometimes I had been used to depasture young stock upon it, but mostly to mow it. Of stock it kept me but a small quantity; and when mown, upon an average it never cut more than about eight fair summer loads. The eddish was of very little value, being husky and brown as an hare's back. I look upon it, at most that the hay, to eat it upon the ground, with the eddish and winter pasture, would not have averaged more than £16. per annum. Since the land has been under tillage, by fallowing with cole-seed every third, and sometimes fourth, year, it has produced me very near ten quarters of good oats per acre. Some years I have had full that quantity, and in this present year very little less. I have also had very fine crops of barley upon it, though in barley it is rather apt to run the straw too long; and although I never sowed any wheat upon it, yet I dare be bound to say, that it would produce us as fine crops of wheat as any land upon this level. The fallow of cole-seed (with a small dressing of manure) has been of much more clear profit (to fold it on the land) than it ever produced by grazing.—Now this

land has been under tillage about ten years, and I will venture to assert, that if it was laid down next spring with white clover, and a proper quantity of rye-grass seeds, that it should keep as much more stock, and be of considerably more value to graze, than it ever was before in any time of memory; of course, the soil cannot be exhausted. The soil of this land is of a mild nature, rather inclining to a sand, the under stratum being quite a bed of sand. I have observed some of the old meadow lands which have been broken up in this country, where the under stratum has been of strong clay, to have a sufficient quantity of mild soil on the top, two or three inches lower than the plough goes, so that the clay shall not adhere to the ploughshare, and the land shall produce as fine crops of turnips or cole-seed, as other lands where the soil is of a mild or sandy quality. The parish where I reside, and the next adjoining to it, contain about 12000 statute acres; and by as near a calculation as I can make, there are at least 5000* acres, which, if converted into tillage, and kept so for six or seven years, and then properly laid down again, they would be of twice the value that they are at present. This is not confined to the two parishes, but extends to numbers of parishes upon this level, that bear a proportion of unploughed land according to the number of acres which they contain.

No. XVI.

Lands not to Plough.—*By Mr. John Mossop, of Deeping, in Lincolnshire.*

Of all the rich clays, good, better, and best, clothed in a fine superfine coat of deep green, such as may be found near Folkingham, good; Melton, better; Market Harborough, best; had I my farm there, I should be very wary in sticking my plough into land of this description, unless I might be permitted to keep it in motion for thirteen years at least; because I am persuaded, when it has been laid down as well as any other land, for the first three or four years, it will not be so good as it was

* A great part of which, for the first and second years, would produce full ten quarters of capital oats per acre.

before it was broken up, and it will be a year or two before it becomes better. This kind of land should never be broken up without due consideration and much caution. It is not improbable but the farmer, by converting this land to tillage, for four or five years only, may lose more than he shall gain. I have no doubt of his profits while kept arable; but after laying it down, he may lose a great part of his profits in one year, by the rot in his sheep, which is no uncommon thing. The unwary farmers have in many places suffered in this way, upon new clay lands, where they have not been particularly careful, both of their stock and draining; and even where they have been attentive to the latter, they have not been exempt from losses in the former.

II.

DRAINING.

No. XVII.

DRAINAGE BY STEAM.—*By Mr. E. Savory, jun. of Downham, Norfolk.*

FROM the best information I can get, a steam engine complete, I understand, would cost about fifteen hundred pounds, having a twenty-horse power, which is supposed to be capable of discharging as much water as a mill with a forty feet sail, when in full velocity. The quantity of coals to work a steam engine of this description, from the same source of information, I learn, would be about twenty bushels consumption in every twenty-four hours.—This expence may be reduced however, in a principal degree, by the collateral heat of an oven, so constructed that in the operation of turning coals into coke, or cinders, it may afford a considerable share of the heat required, and it is supposed to be worth about three-fourths of the price of the coals. The advantages that are to be derived from steam to the fen country are almost incalculable. In case of intense frost, the uniform velocity, with the opportunities of communicating heat, would prevent the engine from freezing, to which, from the uncertainty of winds, the other engines are very much subject. The consequence is, that a great fall of snow coming at the same time, as the mills have not been in a state to prepare the ditches to receive the waters which it occasions, an inundation very generally takes place in the fens; and as the waters rise very rapidly under these circumstances after a thaw, it frequently occurs, that when the mills are set at liberty from the effects of ice, they are for some days incapable of throwing against the head in the rivers, owing to the freshes from the high country preventing a discharge of water from the small into the great rivers.—On the other hand, by adopting the means of steam, the engines would be working in full effect during the continuance of a frost, if necessary, and therefore the ditches would be

in a state adequate to the reception of the waters upon a thaw, as what they previously contained would be discharged into the rivers and at sea at the time of its taking place; and as they usually are low in the continuance of a long frost, the circumstance affords another advantage, until a power can be commanded at will for the drainage of the fen country, it can never attain its full prosperity. Whether the motion is acquired by the power of steam independently of wind-mills, or by attaching steam engines to those of wind, (which I am informed is very practicable) to work only when the weather is calm—I must assert it, as my positive opinion, (which experience and observation daily strengthens), that the benefit to the public will never be equal to two-thirds of what it would be from this description of country, as if the means of steam were resorted to for the drainage of it. As to a district of country which requires draining without any engines upon it, at the time of its being undertaken, it is a matter of doubt in my mind, whether it could not be drained more economically by steam, than by the means usually adopted, although the expence of fuel must certainly be very great. Taking the average of winds, the mills in the winter season do not throw so much water in a week, as they would in one-third of the time, if they went in all the velocity of which they are capable. It follows, that one steam engine, with equal powers, would do as much execution in the course of a season as three wind mills; and, consequently, a great saving would accrue in the first expence, and afterwards in attendance and repairs.

No. XVIII.

TIME OF DRAINING.—*By Mr. Samuel Taylor, of Barnham, near Attleborough, Norfolk.*

THE particular kind of land which I have more immediately in my view, will perhaps principally consist of pieces of rough inclosure, the soil for the most part inclined to what is here called a woodcock, or dark grey wet loam. Some of it is of a sufficient depth of soil; in other parts it is rather thin-skinned, and lying on a clay, or brick-earth bottom, but all capable of producing good corn with skilful management.

I am myself acquainted with many farms, principally consisting of this kind of soil, where the pasture ground bears a proportion of two to one; for instance, in a farm containing 300 acres, two hundred are pasture, and an hundred acres of this pasture perhaps are scarcely good enough for a cow to feed on.—You will be told, that if it is not profitable for this purpose, it is useful in rearing young stock; but let this portion of the farm be put into a state of good cultivation after draining and claying it, and I will venture to say, it will annually produce fifty acres of good corn, besides maintaining as much stock as it did in its original and neglected state. I am convinced that by so doing it would add to the value of the estate, as well as to the comfort and advantage derived by the tenant, from the increased produce of straw, turnips, &c. arising from the fresh broken up land. There would be no injustice in breaking up such kind of pasture as this; on the contrary, it would be in a state to produce a much better layer of grass than before its improvement, should it ever be required to convert it into pasture again.

With respect to the particular mode of treating this kind of land, I shall speak from my own experience, and from the general practice in the two counties of Norfolk and Suffolk.

When a piece of old pasture ground is intended to be broken up, it is generally ploughed in the course of the winter, and care should be taken that the first ploughing is not performed too deep, about three inches and a half is depth sufficient; towards the latter end of March it may be dibbled for oats. The mode of setting all flag land with dibbles is universally practised in Norfolk, but on newly broken up land it is scarcely possible to bury the seed for want of mould, unless planted in this method; besides, by this practice the saving in seed is more than a third, in some instances full half. The produce will vary according to the quality of the land; but I have usually grown from four to six quarters an acre. Sometimes a second crop of oats is taken; and if the land is previously stirred two or three times, so as to break the flag, and destroy the worm (with which fresh land generally is infested), it will succeed very well.

It is generally admitted that no land pays so well for improvement as that which is fresh broken up; as soon therefore as possible the coat of clay (for marl is rarely to be met with on this kind of land) must be carried on to it; the quality of the clay will vary considerably; that of a dark blue colour is generally strong and more tenacious than the light grey coloured clay, which is of a tenderer quality,

full of chalk, and will consequently sooner incorporate with the soil to which it is applied; therefore, wherever the latter can be had without great expence of carriage, it ought to be preferred. From sixty to eighty loads (thirty-six bushels to the load) is the usual quantity, but it will vary ten or twenty loads per acre according to the depth of soil on which it is laid, and the different degrees of looseness of texture in the land.

The clay may be carried on immediately after harvesting the first or second crop; and as the succeeding crop will be turnips, the clay during the winter should be turned in with a fleet furrow (suppose about two inches and a half deep), and if it is wet land, I would recommend under draining it immediately. This is an improvement of the first consequence, and ought to be set about as soon as possible. Sometimes where the land is perfectly even on the surface, and there is no difficulty in procuring a proper fall, the under drains are dug before the field is broken up; but I should generally prefer waiting till I had taken a crop or two, because, after the little inequalities in the land are levelled by the plough, you have, for the most part, a better opportunity of seeing where the proper falls are for the drains; and as the work of carting the clay would be over, you will escape the danger of their being stopped by the wheels of the tumbril, which sometimes is the case; and even when turnips are carted off whilst the land is soft, they are exposed to danger.

The practice of under draining is now pretty generally understood in many counties, yet the Norfolk method of doing it is perhaps the simplest, and attended with the smallest expence. After the drains are set out with a plough, which is done by ploughing as deep as possible twice in the same furrow, the furrows are cleaned out at the bottom with a common spade, the drain is then dug, first with the upper spade, and then with the lower one, the two spades put together will form a taper from six inches (the width of the upper spade at top) to one inch, the width of the lower spade at bottom. After the drain is clean scooped out with a very narrow scoop, fitted to the bottom of it, the whole depth ought to be thirty-two inches; in some places, where there are long veins of sand, a little brush wood or bushes is required to be laid at bottom; if "ling" can be procured, there is nothing so good to lay into the drains, from the toughness and durability of its nature, but where it is not to be had, wheat or pea straw is twisted and laid in, to prevent the earth from choaking the drain: care should then be taken to lay the strongest clay which is dug out, on the straw, and it should be well trodden on. With this precaution,

there will remain a regular hollow for the water to pass along after the straw is rotted away. In many fields, there is required some considerable degree of judgment in setting out the drains: where an oblique fall can be procured, I would recommend putting them in that direction, as the drains not only draw better, because there is usually a fall to them from each side, but they are also less liable to be trodden in when they lie in a different direction from that in which the field is ploughed. The distance between drain and drain must be regulated entirely by the soil; where it is loose, with frequent veins of sand at the bottom, the good effects of the drain will extend a considerable way; but in a stiff and clayey bottom, perhaps, not above half the distance; I have indeed some land where they have answered as completely twelve yards asunder, as in a stiffer bottom they have done at only seven. On some of the very strong land in Essex, the distance from drain to drain is not more than five yards, where it is required to be done to answer the purpose effectually.

III.

PARING AND BURNING.

No. XIX.

CLAY.—*By W. Payne, Esq. Frickly, near Doncaster.*

PROVIDED the land be under old sward, and particularly if coarse or rushy, the process of conversion from grass must invariably be commenced by the operation of paring and burning the sward or turf; which practice on such land, immediately converts what is an absolute nuisance in the way of culture, into an excellent manure, and in such quantity, as cannot fail to produce a strong effect on the soil, for many years to come. This process, so far from exhausting this species of soil, or in any respect diminishing its quantity, as has been asserted by some prejudiced, not ignorant individuals, that it is clearly proved, by chemical and other experiments, by no means to produce that effect when properly executed, and when the subsequent rotation and manuring is properly conducted.

The most approved mode of performing this work, is by turning up the sward or turf, with a well sharpened paring spade, as thinly as possible. When the business is to be done on an extensive scale, let the work be commenced as early in the spring as the weather will permit; this will afford an opportunity of sowing with early oats, such as the Friezland sort, &c. such part as may be in readiness before the expiration of the spring seed-time. This will sometimes succeed when the seed is put into the ground, so prepared, as late as the last week in May, which the writer can attest; the rest of the land may be pastured or mown early for hay. As soon as possible after the hay is off, the paring must be resumed, by way of preparing for the autumn or wheat sowing season. After the turf has received a few days of drought, according to its state, it may be thrown together in small heaps for burning. When this business is performed by task, it is a common practice to

make the heaps too large, which is a material injury, and tends to deprive the soil of one essential advantage, that of the force of heat; for it is always observed, that the strongest and most luxuriant corn is produced on the spots where the heaps of turf have been burnt; of course it is easily to be inferred, that the smaller the heaps the more uniform must be the benefit of the practice on the whole extent of the field. The burning is deemed so critical a part of the business by many, that it is frequently paid for by the day, when the other part is done by task, or per acre.

As soon as the turf is completely reduced to ashes, the heaps may be spread evenly over the ground, and ploughed in immediately at a depth of furrow not greater than four or five inches, in order that the succeeding crops may receive the full benefit of the ashes, as an excellent manure, by their being in a situation capable of being brought up again, at the next and succeeding ploughings.

On lands where the sward is not of many years standing, the benefit of the practice of paring and burning is not so clearly ascertained, nor can it be at any rate so complete.

Rich loams, even when under old swards, may be ploughed, without the previous preparation of paring and burning, provided that there be no reason to fear the destructive inroads of the various tribes of worms, slugs, and other reptiles, which have been generated in those swards; these seldom fail to find a convenient *nidus* for their baneful posterity, under the old turf so turned up by the plough, which in the succeeding spring are too frequently productive of a complete blast to the warmest hopes of the industrious husbandman, by destroying both root and branch of the plants of wheat, oats, &c. sown on lands otherwise in the most completely productive state. These are much more noxious in some particular parts of the country than in others, and remarkably so in some peculiar soils and situations. This prodigious loss and inconvenience is found to be completely prevented, on all old tough mossy and coarse swards, by the practice of paring and burning, which at once sweeps off the scourge and its foster-beds, the old turfs or sods, which otherwise will lie for years and years among the soil, without being sufficiently decayed for the purposes of cultivation. The great criterion for this operation is, that for all old swards in general, it may be safely recommended as a convenient and salutary mode of at once converting all rubbish, grass roots, &c. on the surface of land, into a good manure for almost every species of soil; yet the

thinner the sod is pared the better, particularly on dry soils. On clay soils, the thicker paring may be attended with some amelioration. On young swards this work is not necessary, but it may be allowed to be of probable advantage to cold and sour clays even in this case, provided the sward be of eight or ten years standing.

No. XX.

Clay and Chalk.—*By Mr. Morris Birkbeck, of Warnborough, near Guildford.*

Paring and burning is an operation so well adapted to the purpose of converting grass land to a temporary course of tillage, in every view of the subject, that I have no hesitation in proposing it as the first step, in all soils and situations; though I am aware that strong objections to the practice have frequently been made, and supported by plausible reasoning. After explaining the grounds on which I recommend it, I shall take some notice of these objections.

Although good crops may occasionally have been obtained from newly broken ground, the vegetable stratum, in its crude state, is not generally favourable to the production of grain, on account of the sponginess of its texture.

By paring and burning that portion of the turf which contains from three-fourths to four-fifths of the undecayed fibres, is, at once converted into a substance the most favourable to vegetation; and the spongy quality is completely corrected, whilst not more than two inches in depth need be disturbed: thus securing in an effectual manner, the best preparation for grain, and the means of the restoration of the turf.

Objections lie against this practice, from the supposed waste of vegetable matter; and some persons alledge that the soil itself suffers diminution.

The latter opinion is not entertained by those who are aware of the refractory nature of earths in general; and the former will probably lose much of its weight, when it is considered, that the fixed principles of plants which are the result of combustion carbon, phosphate of lime, and fixed alkali, are speedily converted into

vegetable nutriment; and that it is only by combustion, or a slower decomposition, which also suffers the volatile parts to exhale, that this change in the vegetable fibre can be effected: therefore the competition in bulk, supposing that the criterion is not between the ashes of burnt vegetables, and the vegetables in a perfect state, but between the ashes, and the result of this slow decomposition, when as nearly approaching to vegetable nutriment. A great reduction takes place even in rotten dung, before it is fitted to enter the vessels of plants; and in the comparison, the value of the time saved should be thrown into the scale. That something is lost by this process, to the particular field, the volumes of smoke which are seen rolling over the hedges plainly testify; but as this is principally water, coloured by a small portion of oil, it is probably of less importance than the carbon which escapes in gas, when the combustion is complete. The same effects are also produced by fermentation. If dry straw be burnt in the open air, a very large proportion is dissipated; but it is otherwise with the roots of grass collected in heaps, and enveloped with earth. The loss in this case, is less considerable; as a great part of the plant is merely converted into charcoal. From comparing a quantity of straw with the remains after combustion, I was long of opinion, that, to burn a vegetable which might be converted into manure, was the extreme of prodigality; but facts occurred, which it was impossible to reconcile to this theory, and which compelled me to a different view of the subject. Some of these I shall relate.

Two fields, making together about fifty acres, were laid down in an exhausted state. When they had acquired a turf, one received a summer's and winter's fallow; the other was pared and burnt; and both were sown with barley and seeds. The effect was strikingly in favour of the latter, both in the barley, and the seeds which followed.

Another field of the same quality, twenty-two acres, was pared by the plough in the spring of 1799; and about half of it was harrowed repeatedly during the summer: the wetness of the season prevented the burning; but as the turf was completely killed and much broken by the harrow, this part of the field became a good fallow. The remainder, not being disturbed, set again; and the following spring was nearly as green as before. In the succeeding summer the operation of burning was thoroughly performed: where it had not been previously broken by the harrow, the entire turf, down to the chalk, was subjected to the fire; and in the other, though nearly decomposed by two years fallowing, enough was burnt to

produce a tolerable sprinkling of ashes, to stimulate vegetation if that were their property. This field affords a fair opportunity of deciding betwixt the two modes of reducing old turf to tillage. I expected, that in this instance fallow would have taken the lead by the help of the ashes; but, in the turnips now growing, the odds are very much in favour of the pared and burnt land. A stranger would be struck by the difference; and unless the succeeding crops, and future condition of the land, should be different from the present appearances, all doubt in my mind, as to the effect, will be at an end.

I have had proofs equally decisive, on clay and loam, of the preference of paring and burning, to fallowing and to sowing on the fresh turf; but have never had occasion to observe the impoverishment from the former, which I had suspected. Indeed the reverse has in every case been so obvious, as to amount in my judgment to very strong evidence, if not to demonstration.

I believe that if the crops on equal quantities of land, subjected to these different processes, were accurately weighed for two or perhaps three years, it would be found that the produce of the pared and burnt land, would exceed that of the fallowed, by more than the whole amount of the turf consumed. This might be submitted to experiment; and if proved to be so, the only formidable objection to this operation would be done away. Should not this extraordinary produce be replaced by manure, the soil will no doubt suffer exhaustion; as would be the case, in proportion to the crops obtained, under any kind of culture.

If plants are suffered to decay on the spot where they grew, they repay, with interest, the soil which supported them; witness the vegetable mould which covers the earth, in all situations undisturbed by the plough. Thus, when a crop is expended on the field which produced it, the field is enriched; and the larger the crop the greater the acquisition. Taking the quantity of vegetable matter as the criterion of fertility, land which has been pared and burnt will probably, at the end of the third year, if managed on this principle, possess it in a higher degree than fallowed land; with this additional advantage, that, during the three years, a much larger proportion of vegetable matter will have undergone the change which agriculture is intended to effect.

It is not perhaps impertinent in this place to enquire, how an accumulation of matter so dense may be acquired from the atmosphere.

The carbonic acid gas, is probably a powerful agent in the growth of plants.

They may be indebted to the decomposition of this gas for a part of the oxygen which they exhale, and of the carbon which constitutes the vegetable fibre, and becomes the substance in question on its decay. The proportion of carbon in this gas is to that of oxygen nearly as twelve to fifty-seven. Thus, the existence of carbon in the æriform state is acknowledged; likewise an increase of soil consisting principally of this substance produced by the growth and decay of plants. The decomposition of the carbonic acid in the process of vegetation may have been proved: I offer it as a conjecture.

It seems clear that the acquisition, however obtained, will be as the quantity of vegetation; therefore land which has been pared and burnt, producing larger crops, will acquire more than fallowed land, to compensate for the loss sustained in the process.

I conceive it unnecessary to describe the operation, it being well known in most parts of the kingdom. Workmen who understand it, are in the habit of travelling to a distance for jobs: such should be engaged; they will perform the work better than strangers to it can, with the best directions; and the labourers of the neighbourhood may acquire the practice from them.

No. XXI.

Poor Clay.—*By Mr. W. Elmhurst, near Horncastle.*

I shall speak from long and real experience, respecting paring and burning. As I have had, for a considerable number of years, great concerns in the management of a variety of soils, I shall in the first place, speak to the management of clay land, of a poorish sterile sort; on some large quantities of old common land, that had never been ploughed before, and on others of the like nature, of which I have had the management (both my own and rented lands), I have ever pursued this system of management, and have always found it to answer, in all respects.

After properly draining such as wanted it, I pare an inch, or one inch and a half thick, about lady day, and get it well burnt. So soon as all or a good part of the

piece is burnt, I spread all the ant hills as level as possible upon the ground betwixt the ash hills. I then have the ashes all evenly spread, and as soon as a tolerable rain comes, I have the whole well harrowed, and plough a shallow furrow for turnips, and for the most part have had very good crops; which I always eat off with sheep. As the land is not broken up too deep, as soon as the turnips are eaten off, and the land is dry enough, I have it ploughed up again into small lands about two inches and a half, not more than three deep; and with two more ploughings and harrowings in good time for sowing it with cole-seed, and then barley. I have often had more than six quarters per acre, and the next year, from five to six quarters per acre of wheat, upon poor land, by this process; and in various parts of the country, where I have for many years occupied such lands, paring and burning such sort of land, is the very best practice that can be used, as it tends to the enriching of it, by the greatest quantity of manure that can be possibly obtained. It is the best as well as the cheapest manure that can be, for all such land, and I think it is the very cheapest and readiest method of bringing into a good state of cultivation and profit, all moory rough lands. I have ever found it so, both by practice and observation for many years. It is wonderful to see the great improvements which have been made by this beneficial practice, when done by judicious and prudent men, not endeavouring to get too many crops. But for sand, I shall put a positive and absolute negative against paring and burning; as being one of the most ruinous and destructive modes of proceeding with any sort of sandy land, that can possibly be had recourse to, for being light and sharp of itself, it will most certainly be rendered more so by calcination.

No. XXII.

Poor Cold Clay.—*By Mr. W. Maxey, of Knotting, in Bedfordshire.*

The best means of converting grass lands, on poor cold clays, into tillage is, after first draining all the wet parts, to pare and burn, by means of which (barring seasons) an immediate succession of good crops may be depended upon; and by intervening crops of vegetables, with the advantage it receives in the first instance from the ashes, this land will require but little dung for a number of years; consequently there will be a great surplus of dung, which may be applied to greater advantage elsewhere. The corn on this kind of land, whilst in a new state, is apt to run too much to straw, and in fruitful seasons at earing time, whereby both quantity and quality are much reduced. I have frequently discovered in my own practice great errors, by doing too well by land of this description. It is an essential point to know where and when to apply dung to the best advantage. I have heard many objections against ploughing this land, but more particularly to paring and burning, therefore I will state my experience thereon: thirty years back I broke up a piece of sward of this description, one part of which I pared and burnt, another I ploughed with horses and a common plough, ground sharp, as thin as it could be, which part I also burnt; the remaining part was fallowed the succeeding winter. The part that I ploughed by horses, which was about five acres, abounding with ant hills (which consist entirely of clay), I was under the necessity of burning in large heaps, whereby a great portion of the essence was destroyed. On this piece I had more ashes than could be used to advantage thereon, and from which, after spreading a double portion, I manured eight acres in an adjacent field. Now were burning so prejudical as has been represented, this piece must have been utterly ruined. The two pieces thus burnt were prepared for wheat, and in due season sown therewith; the other with oats, which was a very poor crop, owing in some measure to the grub and other insects, to which this kind of land is subject, and which in a great measure are destroyed by the preceding process; the wheat on both pieces was very fine, but that which was ploughed by hand was somewhat better, which I ascribed

to the superior quality of the ashes, they being the product of the surface only, and burnt in small heaps. In the course of cropping that followed, the parts burnt were so much superior to the other, that I shall not exaggerate if I say, I had more profit from an acre of that burnt, in three years, than in five from the other part. It is worthy of remark, that those spots where the large heaps were burnt, on which the whole surface or staple quite to the clay was consumed to ashes, yet by their situation not to that degree, as was the bulk of the heaps (the fire not being so strong next to the ground), but so as to retain its essence; not only produced the most luxuriant crops at first, insomuch so that I have been under the necessity of mowing them down twice, and yet have had too much at harvest; but continued for a number of years superior to any other part of the field. When I have manured this field, I have avoided laying any dung thereon, and yet it is at this time, after a lapse of thirty years, equal to any part of the land. This confirmed me many years back of the propriety of burning, and is a demonstrative proof of its efficacy and advantage, and a full refutation of all the objections which I have heard advanced to that practice. The advantage of burning, in many instances is much greater than I have described, as much depends upon the season. If it should prove a fine dry time, the turf may be burnt much more quickly, and in smaller heaps, whereby the quality is rendered far superior than it can be, in wet unfavourable seasons, when it cannot be burnt in such small quantities. I particularly recommend that it be burnt in as small quantities as the season will admit; if only scorched, the better. For the above reasons, I recommend paring by hand in preference to that by the plough. In further proof of the advantage of burning, I will state a recent experiment of two neighbours in an adjacent parish, where an inclosure took place five years back, at which time they had each a portion of waste or common laid to their allotments, adjoining to each other of equal quality: the one who is the proprietor pared and burnt, and sowed in succession with cole-seed, barley, wheat, wheat, barley; all of which were good crops. The land is at this time under winter tares, which he proposes feeding off with sheep, and sowing it with wheat again in the autumn. Although I cannot recommend such a course of cropping, yet I doubt not, as the prices of the produce have been, but that he will profit very much thereby; and that its own produce of dung will more than compensate the expence.—The other farmer, who is a renter (probably like the majority of renters under some injudicious restraints, laid down by some famous land *taster*), fallowed his land in the winter,

sowed barley, oats, cole-seed, and barley, all of which were very poor crops. The farmer calculates that he has made a profit of from fifteen to twenty pounds an acre more than the latter, and that his land is in a far superior state for any succeeding crop. It is objected, that land which is burnt will not bear clover, the fallacy of which I have proved in many instances, having always found the clover on such land to be equal to that on land which is not burned; but this I have also discovered, that no land of this description whilst new, either burnt or not, will bear clover to advantage: it must first go through a course of cropping of at least five or six years, when it will be of a better texture for that purpose. Respecting the depth of ploughing lands to be burnt, it should not be deeper than is necessary to obtain a sufficiency of tilth for wheat, and to keep the ashes in contact therewith, as by a deep ploughing the first time, or before the ashes are sufficiently mixed with the soil, they would be sunk so deep, that this efficacy would be lost in a great measure.—In the subsequent ploughings, when preparing for cole, or for spring cropping, it is advisable to plough somewhat deeper, as these crops thrive best in fine deep tilths.

I will recite another experiment of my own, made four years back. I had permission to break up a piece of sward, part of which I was compelled to break up in the spring, and sow with beans for the sake of experiment. I reserved an acre of this land so broken up, which I did not sow, but tillaged it throughout the summer, with the remaining part of the field, which I pared and burnt; and in the autumn sowed the whole field with wheat. The advantage to the burnt land, as near as I can calculate, is in the proportion of three to two, as to the acre summer fallowed and not burnt; and of four to one, as to that sown with beans. About twenty years back, a neighbour of mine broke up a piece of sward of this description in the winter; his method, which appeared a very good one, was to plough two furrows deep, throwing the second furrow immediately on the first, by which means he obtained an abundance of tilth; in the spring following it was sown with oats, which was a very poor crop, as was every succeeding one, for a number of years, being constantly destroyed by the grub and other insects. I think this suffered more thereby, than any I ever noticed before or since; I account for it in this way, that the turf, which contains the insects so destructive to grain, being thrown so deep, preserved them from being exposed to the crows, and other fowls of the air, great numbers of which will follow the plough on these occasions, and to them we are

much indebted (by frequent ploughings) for the destruction of those insects. Thus a summer fallow after burning, is profitable to sowing cole-seed, as the frequent ploughing and harrowing in the preparation for wheat, exposes such insects as escape the paring iron and the fire: it is an essential point to take the most effectual means in the first instance of breaking up sward which is subject to those destructive insects to destroy them; and the summer is the most likely time for that purpose, being a scarce time of food with the crows.

No. XXIII.

Good Clay.—*By Mr. John Moss, of Seven Grange, near Beverley.*

On land in general, where there is any tolerable depth of soil, paring and burning is the most profitable, and in most cases the best operation, though many gentlemen are prejudiced against it. I will give an instance within my own knowledge, of a farmer breaking up several closes of old sward; one of the best he ploughed (about twelve acres), and the rest pared and burnt. The first year he lost £100.; the second, £100.; the third, £50. for want of paring and burning; the whole loss £250. being more than £20. per acre, at that time about two-thirds of the value of the land. This was a fine sweet sward, and has not been superior since to the pared and burnt land, on account of cropping about twenty years.

This was good clay soil; nevertheless, fine deep sand, as other light soils, will answer tolerably well to be ploughed out; where this is the case, it should be ploughed five inches deep: in cold thin lands, four inches. The best manner of laying most land to grass, particularly such as is not turnip land, is to sow the seeds upon the fallow in the beginning of August; in this case the landlord to find seeds; in all cases, the seeds pastured the first year by sheep and other small stock, and manured in autumn.

No. XXIV.

Clay—*By John Morris, Esq. of Glamorganshire.*

In peat or clay soils, or such as may be overgrown with furze, fern, rushes, or foul with roots of any sort, paring and burning is the most advantageous mode that can be pursued; but on rich old pastures, free from such incumbrances, I would not recommend the practice.

Paring the soil is either done by a mattock, or by a breast plough. It is only by the first instrument, that this improvement can be worked on grounds incumbered as abovementioned; the latter tool is only applicable, where few or no obstructions occur.

The process of burning is simple, as it consists merely in collecting the surface that is cut up, into small heaps, and when properly dried, reducing them by fire into ashes.

Sometimes the soil may be in such a state as to permit the farmer to cut up the surface with a common plough instead of a breast plough, or mattock, which is a considerable saving of expense in carrying on the work.

I have found the greatest benefit, in the treating of all stubborn clays, by burning part of the soil into ashes, and mixing it with lime and peat, or peat ashes, if these valuable assistants are to be obtained at hand, as I have found them.

No. XXV.

Strong Wet Land.—*By Mr. John Johnson, of Welton, near South Cave.*

On a farm I purchased of 173 acres, 120 of which were plain land, and the rest wood and coppice, having but little grass, I determined to have a little more, and to make a meadow of a piece of old pasture. This having a marly substratum, over which was a yellow clay, a foot or two deep, and the top being a wet magotty and coarse mould, filled with coarse grass roots, rushes, and other weeds, I pared it deep and burnt it, and added about 100 bushels per acre of good chalk lime. The ashes were spread even over the field, which was about nine acres; this done, it was ploughed up four inches deep with oxen; it was afterwards ploughed and trod well with oxen, and harrowed well with a heavy harrow; and by these methods well broken, pulverized, and mixed: and after that, ploughed into four ridges occupying seven feet, with furrows twelve inches deep in the parting of the ridges, which were laid pretty flat. This was sown with the strong bearded wheat in October; two bushels per acre. This wheat came up and did well through the winter; it came on, and did well the next summer, and produced more than ten sacks per acre. The next crop was barley and seeds; the barley being sown light with three bushels per acre, and the seeds thick; two gallons of red clover, one of cow-grass, the same of trefoil, and a bushel of ray-grass per acre. The next year's seeds mowed for hay, produced more than two tons per acre; the after spring of seeds was fed off with neat cattle, horses, and sheep. The next spring, to the latter end of April, after being fed off very close with sheep, the ground was fallowed up seven or eight inches deep, and through the summer turned backward and forward four times, and limed with stone lime 140 bushels per acre, well harrowed in. It was then ploughed into seven feet ridges pretty flat, and twelve inches deep furrows between each ridge, and sown with red Hertfordshire wheat, two bushels per acre, the beginning of October; and with many very deep oblique water furrows to keep the water drained off the field as much as possible. It lay pretty dry; the wheat

came up thick and well, tellered out wonderfully, and became next summer a surprising crop for our country; full twelve sacks of very full corned heavy wheat, 65lbs. per bushel Winchester measure. The weather for the whole time was pretty favourable. This was in the year 1788. Being determined to lay this field down for grass, in hopes of making a good meadow, I took the following method; and first, considering that it, before ploughing up, was wet, sour, and very tender, I determined if possible to make it dry and sound; and the ridges and deep furrows running obliquely across the field, I deepened them with a plough constructed for such purposes to sixteen inches below the common surface of the ridges, and then with a hollow trunking fifteen inches the pod, five inches wide at top and three at the bottom. This deepened the drains fourteen inches more, and made them now full thirty inches deep. Having some very strong and sound wheat straw, I had it twisted and curled into wads about four or five inches thick and two and a half feet long. These were put down in the drains close, end to end, and rammed pretty tight, the drains being left six or nine inches deep open under them, and generally in clay over the under substratum of marle. I did not fear their filling up, the straw effectually preventing the passage of all earth from above, and underneath the straw in the open drains, no frost could ever reach; every other of the ridge-furrows all over the field were thus managed, and the most wet hanging parts, every ridge-furrow; therefore the whole field was drained with drains under ground at about fourteen feet distant, and the wetter parts at seven feet distance. The field being now, as I apprehended, well drained and secured from too much wetness, which afterwards proved to be the case, I ploughed it up the full depth before Christmas, and in March I ploughed it again, by turning the furrows back, and let it lie till the middle of April. Having now a good mixture of compost well mixed together, consisting of fresh mould three hundred cart loads of fourteen bushels each, and 600 bushels of lime, 200 cart loads of farm-yard dung and town dung of every sort, from all soil-holes, vaults, and dung-hill-drains, besides soot and ashes, altogether about one hundred cart loads, which with the other made the compost mixture about 800 good cart loads; the whole was spread over the field and well harrowed in. The barley was then sown two bushels per acre, and seeds as follows; choice grass-seeds well cleaned, two bushels; red clover, nonsuch, cow-grass, each ten gallons, and ray-grass ten bushels. The barley and seeds being harrowed in, and then close rolled down, it was left for the barley and seeds to sprout; they made their appearance in the

beginning of May, and all came up exceedingly well, the seeds very thick; the seeds were very little eaten with the fly, and all grew well till the barley got ripe to cut, which was done late in August. The barley and seeds made a very large swarth, three loads on the acre out of the field. The clovers much headed the ray-grass, and I had some ripe seed, with the trefoil in bloom. On threshing, the barley produced near eight sacks per acre, and the fodder was very good for horses and beasts: and they all did exceedingly well with it; the after-growth was picked off with horses and young beasts, but chiefly by sheep in October, after which it was let lie through the winter without any thing running upon it. Next spring it came very strong forward and thick from all the seeds, and at mowing in the beginning of June, produced more than two and a half loads per acre. The growth of the clovers was strong, and it was first fed off with horses and neat cattle, and afterwards with sheep. After Christmas, between four and five hundred loads of pretty good compost were thrown over it in a frost, and well dragged and rolled. In March, the field being dry and in good order, the clovers, ray-grass, and hay-seeds, made a thick sward, and produced two loads and a half per acre. This field has ever since produced in general two loads per acre, except in a very dry summer. It is now an excellent meadow, pretty dry and firm from the under-ground drainage.

Densharing and burning the turf always pays well on our marley soils and clayey gravels, and cannot be repeated too often whenever we can get a turf by sowing hay, and other seeds. To cut and burn that turf, will be exceedingly proper for these heavy soils, and it is the cheapest mode of amendment that can possibly be employed.

Strong Lands.

Of this land I had about fifteen acres, the greater part of it never before in tillage. It lay in two divisions, and was taken up in two following years. The first was pared with the spade for burning; afterwards I intended sowing it with rape for seed, but the season proving wet, very little of it could be burnt, and not thinking it fit for rape without burning, the purpose was given up.

In the following spring, fearing the grub, I durst not sow it with oats, I therefore determined to give it a thorough fallow. At this time the other adjoining part was pared; this being very strong land, I purposed great care in the burning. I had long been a strict observer of paring and burning, and, very often was not well pleased with the management of it.

When the turf was dry, I went with some of my servants to the spot. Some fires were lighted through the field, which when burnt up, I ordered the men to kindle many more, traversing them in proper directions for lighting others the next day. In the morning, when I came to the field with additional assistance, I found my servants had done nothing more than make up, in very large heaps, those fires, which were made whilst I was with them the preceding evening. The heaps were now in red hot fire, and in the middle of them were run together as bricks do, when too much burnt, in a kiln. From this specimen of burning, and the disobedience my servants had shewn the preceding evening, I hastily ordered the fires to be put out, and determined to give up the burning altogether. A few days after some of the men, being ashamed that the work should be thus neglected, and the blame imputed to them, proposed to resume the burning, and promised the most strict attention to my orders. It was immediately resumed and soon effected. My object was to destroy the turf; and preserve the soil. Had the fires been made in the usual way, the greater part had been burnt to dead red ashes, but by spreading the turf as soon as it could be said to be full of fire, the ashes appeared black when spread, and in a far greater quantity. By this strict attention in burning, though I incurred an additional expence, it was amply repaid me by a vast increase of ashes, whilst no injury was incurred by the soil.

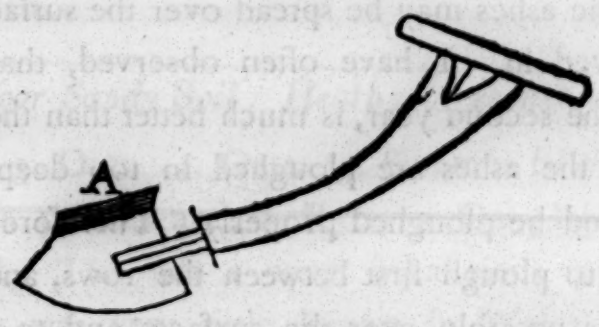
We find by this process, that the strongest soils, where there is sufficient turf, may be burnt without injuring the ground by spreading the ashes in full fire.

Both these pieces were taken into the same course of management, and are now under the plough; the part burned, cropped better, both in quantity and quality, for two or three years. There is at present no observable difference between these two pieces of land, but the quality naturally accounts for it.

No. XXVI.

Clay, Sand, and Loam.—*By the Rev. W. Pryce, of Haddingham, Thame.*

The instruments used for paring are of two sorts, in the Principality, where I saw it practised principally: they use a broad mattock made for that purpose, and called in their dialect, "kaib batting;" *i. e.* "paring mattock." There is another instrument used in England for paring, where it is practised; this is called a breast plough, from the manner of using it, being pushed with the breast, by the man who pares. A sketch of this instrument with the pencil, may convey a better idea of it, than the most elaborate description can. It is made nearly in the manner following.



At A there is a small edge turned up, which cuts off the furrow, or paring, from the rest of the green-sward, by means of which, when the paring is cut of a proper length, it is turned over with the cutting iron.

Land should be pared in March; if convenient, it should be finished by the end of April; I have seen it done late in May, but it is seldom burnt so well as that done sooner. When I was concerned in this species of cultivation, I generally began about the middle of March. When this operation is performed with a paring mattock, the sod is always turned up in the form of a cone, very small at top and broad at bottom, and is therefore almost sure to dry on any soil, being so well exposed to wind and sun; but if this be done with the breast plough, care must be taken to set up the sods in the best position for drying. This method of breaking up from grass many sort of soils, is incomparably the best that can be adopted, and

provided it be conducted with propriety, it will not fail of success sufficient to gratify the most sanguine expectation. As so much depends upon the due management in paring and burning, it requires for that reason a greater share of minuteness in the instruction. In regard to the depth to which land should be pared, respect must be had to the nature of the soil, and the state of the land. Should it be clay soil of any description, the paring should not exceed an inch deep, for it will dry the better; but on peaty and sandy soils it may be somewhat deeper, especially if the land should be fibrous and rooty. When the sods are perfectly dry, they should be collected on heaps and set in regular rows, in order to plough between them, which is a much better way than ploughing the ashes into the soil, which I have seen frequently practised. Care must be taken in laying the heaps, which should not be too large; about a good wheel-barrow full will be sufficient in a heap. Some sods on certain soils will be easily calcined, where the surface abounds with heath, sedge, &c.; but where this is not the case, it will be needful to add some combustible materials, that the whole heap may be completely reduced to ashes. After rain, the ashes may be spread over the surface of the field, and the seed sown and harrowed in. I have often observed, that when the ashes are ploughed in, the crop, the second year, is much better than the first; and the reason is, that very frequently the ashes are ploughed in too deep, which is almost sure to be the case, if the land be ploughed properly. Therefore we recommend it, as much the best method, to plough first between the rows, and afterwards to scatter the ashes as regularly as possible over the surface, and to clear well from under the heap, to prevent too great luxuriance of crop.

Paring and burning have been practised with success, on the following different soils, within my observation. 1. On strong clay, and old low common, abounding with mole-hills. This soil is too strong and too wet for turnips; it is congenial only to wheat and beans. 2. On poor sandy soil, over-run with heath. 3. On red loam; surface covered with moss. 4. On unfertile cold white clay; surface sedgy, and part of it rushy. 5. On peaty soil. I have been informed, also, that paring and burning have succeeded well on an old pasture of rich sand over-run with moss; but as I have not seen this, I shall not notice it any farther.

In the course of cropping under most of these experiments, a good practical farmer might easily perceive glaring errors. I shall give them simply as they stand, and then make some strictures, as I pass on.

Experiment I.—*Strong surly Clay Soil, too strong and too wet for Turnips; broken up by paring and burning.*

Course of cropping: 1. Wheat. 2. Wheat; abundant crops; the second the best. 3. Beans. As this has not been laid down to grass, we will pursue the crops no farther; this has answered admirably well. Therefore on old pasture of strong clay soil with mole-hills, &c. paring and burning have answered better than any other process in breaking up from grass, at least in this instance; for soil exactly of the same quality has been ploughed up, and it has not answered near so well. This experiment was made in the parish of Doddershall, Bucks.

Experiment II.—*Cold white Clay; Radnorshire. Under drained, pared and burned.*

1. Wheat and rye mixed, called "meslin." 2. Oats. 3. Dunged for oats, and laid down with ray-grass $2\frac{1}{2}$ bushels, and hay-seed. The land was improved, and produced grass very well.

Experiment III.—*Poor Sandy Soil; Heath; Breconshire. Pared and burned.*

1. Rye. 2. Oats. 3. Oats. 4. Oats. 5. Summer fallowed, limed and dunged, mostly with mud from ponds; and, 6. Rye. 7. Oats, laid down with ray only, quantity not minuted. This was a very injudicious method of management. The utility of turnips was very little known in Wales about seventeen years ago, nor is it now universally understood there. I think it would have been a better course on this land after paring and burning. 1. Turnips. 2. Barley. 3. Pease dibbled and hoed, limed on the surface before hoeing. 4. Turnips fed on the land. 5. Barley or oats laid down with seeds. This course would have improved the land much more than the other.

Experiment IV.—*On Red Loam; pared and burned; (Surface Moss).*

1. Rye; and five successive crops of oats: wretched bad management: laid down with hay-seeds. Poor farmer indeed (in the parish of Llangonog, Breconshire); a better course on this good loam: 1. Wheat. 2. Barley. 3. Pease. 4. Wheat dunged. 5. Barley. 6. Turnips limed. 7. Oats laid down with seeds. My uncle occupies this same farm now, and has for about twenty years; the last course has

answered remarkably well, and greatly improved the land by paring and burning. The seeds he lays it down with, are one bushel of black grass, *i. e.* trefoil not milled; 7lbs. of red clover; and one bushel and a half of ray-grass; grazed first year generally with milch cows, and pigs; seldom sheep before the second year.

Yet I think this would have been a better course than the last mentioned: 1. Turnips. 2. Barley. 3. Pease. 4. Wheat. 5. Turnips. 6. Barley. 7 Pease, limed on the surface before hoeing. 8. Wheat, dunged. 9. Oats with seeds. Lime is cheap in this part of the principality, and it is found by experience to be very beneficial to the land.

Peaty soil in Wales, is exceedingly unproductive without some manure; it is frequently mixed with blue clay, which is infertile and cold; but in some places in Breconshire, and Radnorshire, the soil is pure peat two or three yards in depth, with a substratum of bluish clay. I am fully convinced from my own observation, that peaty soil, mixed with a proportion of argillaceous particles, would pay for cultivation. Paring and burning would undoubtedly be the most eligible method of breaking up this soil; but in very dry weather, the soil beneath would be very inflammable, and in this case it would be advisable to fix on a proper spot to burn the sods in a large heap, which if laid up in proper form, would quickly be reduced to ashes; for the paring of this soil when dry, is more sure to be completely calcined than any other. By adopting this method, the inconvenience of burning pits in the soil beneath could be avoided; a circumstance which happens however only in very dry summers.

As far as I have observed, black and brown oats succeed the best on this kind of soil, but not without manure, if ploughed. On paring and burning; 1. Rye. 2. Oats. 3. Oats. And then manure with horse dung, or sheep and hog dung, and lime if convenient; then it bears oats best, *i. e.* better than any other grain. Laid down with the third crop of oats after manure, and three bushels of ray and some hay-seed, bears good grass for twelve or fifteen years; if dunged on the surface with short dung or ashes, it will do it much longer.

Experiment on this soil; pared and burned.

1. Rye. 2. Oats laid down with ray and hay-seed; quantity not mentioned; mown afterwards, and answered very well. This piece produced hardly any thing before, but very good hay afterwards.

I have met with some farmers who are prejudiced against the practice of paring and burning, under a supposition that the fertility of the soil is exhausted by this species of cultivation. From a desire of being satisfied as to the reality of this supposition, I have attentively and accurately observed the effects of paring and burning for a series of years, and the result has been, a thorough conviction of the vast utility and advantage of this practice, from a variety of cases too numerous to mention in this essay. I would therefore recommend this method as the best that can be adopted, in breaking up, and improving waste lands; by this method land will speedily, amply, and abundantly pay for cultivation. This way is also the most effectual and profitable of breaking up from grass, old cow pastures abounding with mole-hills;—of strong clay soils: and provided it be managed properly, it greatly improves any poor soil. In clay soils, the effects of the ashes as manure will endure much longer than on loose sandy soils; therefore the latter will require manuring after paring and burning, much sooner than the former. Good strong clay soil will produce abundantly for six years without any other manure, but poor sandy and peaty soils should be manured in the third year.

The whole of the paring should be carefully calcined; for, to adopt Pliny's phrase, in the *micæ salis*, or saline nitre of the ashes, consists all the virtue which operates as a manure to the soil.

Courses of cropping recommended on various Soils, in cases of paring and burning.

I. Strong clay. 1. Wheat. 2. Beans drilled and hoed. 3. Wheat. 4. Beans as before, only dunged. 5. Wheat. 6. Oats laid down with 12lbs. of white clover and 7lbs. of trefoil, dunged on the surface the second year, and if the seeds fail, sow some on the dung, and harrow with a bush harrow. The land will be greatly improved; perhaps if grazed with cows the first year it would be better.

II. Poor sandy soil; warren; heath; gorse; mossy, &c. 1. Turnips. 2. Barley. 3. Pease. 4. Turnips, always fed on the land. 5. Oats, laid down with 3lbs. of red clover, 4lbs. of trefoil, $2\frac{1}{2}$ of ray; but five bushels of sainfoin much better.

III. Peaty soil. 1. Rye. 2. Oats. 3. Oats. This is not a good course of cropping, but hardly to be avoided on this sort of poor soil; except it would bear rape or cole; but laid down with the third crop of oats, and three bushels

and a half of ray, some hay-seed, and mown the first year, the land will be improved.

IV. Infertile cold clay; surface often sedgy, rushy &c. 1. Wheat. 2. Pease dibbled and hoed. 3. Fold penned for wheat. 4. Pease as before, or beans drilled and hoed. 5. Fold penned for wheat. 6. Oats, with 8lbs. of white clover, 6lbs. of trefoil, three bushels of clean hay-seed, the land ashed with forty bushels per acre upon the seed, and harrowed with a bush harrow, and grazed with cows the first year; if to remain for grass, dunged with short dung the second year, and more seed sown if necessary, and harrowed as before.

These courses are recommended under the supposition that the land is to be greatly improved. The charge and expence for paring and burning from £1. to £1. 5s. per acre.

No. XXVII.

Clay; Moors; Heaths.—*By Mr. Henry Hoyte.*

This valuable preparation and manure, produced fit for the soils which I shall describe, previous to conversion, is in my opinion one of the first improvements in agriculture, if the land be properly treated afterwards. It has unjustly been brought into disrepute by an improper system, pursued by avaricious, selfish, or ignorant men, who too frequently have, when not restricted, taken two, and even sometimes three, successive white straw crops following. This barbarous and exhausting system every judicious farmer will justly condemn, well knowing that such soils as are proper to burn, are generally sterile in themselves; consequently, this process should be directed with the sole view to improve the soil by a succession of crops, judiciously chosen, so that a progressive and permanent improvement should follow. This, if properly attended to, will, I am persuaded, be the best preparation for ensuring it, and which no other means in the first instance can so readily effect; for burning immediately converts all coarse vegetable roots, &c. into useful matter, and at the same time destroys grubs and insects, so destructive

to corn and vegetables. Upon heavy strong cohesive clay soils, burning ameliorates, and enables the roots of clover and seeds to shoot and expand, by which means they become more luxuriant in their growth. In the first instance it is certainly right, on all turf moors, with peaty bottoms; ditto, with clay or gravelly bottoms; all heaths, producing furze, gorse, or coarse sedgy grasses, and all cold clays; in short, I may add, on all lands producing coarse herbage and bad grasses. The depth of breast ploughing previous to burning, depends on the surface or soil to be pared, *viz.* the more coarse vegetables and roots you have, the deeper it will admit of burning; consequently, an opportunity is given of producing a greater body of ashes; it therefore may be considered as an acquisition, where lands will admit of it. I would recommend on all clay soils, and such as require deep paring, to have the paring completed in the month of December, or January, previous to burning, that it may lie through the winter, so that the frosts may loosen and moulder away the clay and earth from the vegetables intended for burning. This will be the means of preventing the ashes from turning red, and burning to a brick, which will be the case if proper attention be not paid; therefore in the spring, previous to heaping, harrow your land already pared with heavy harrows.* This will completely shake off the strong earth, and leave the pure vegetables for burning; great care in burning should be had not to permit the flame to break out, but to keep your fire smothered, and your heaps small, otherwise in the first case your ashes will burn red, in the second, your manure will be partially laid on your land.

Mr. Patty, late of North Leach, in the county of Gloucester, who is well known in that county, and several others, as a very able agriculturist, declares that long experience has confirmed him in the opinion, that burning is one of the best preparations on certain soils that can be adopted. In short, on poor soils, without this method of practice, manure could not otherwise be procured; and he never yet found the land injured by burning, if judiciously done, and properly treated afterwards. I shall beg further to establish his opinion, by mentioning a process, which I directed on a clay soil, and the good effects arising from it, stand at this moment a sufficient proof of the truth of my assertions. A gentleman in the county of

* N. B. If care is not taken to burn immediately after harrowing and previous to the falling of any wet, it may occasion great delay and additional expence, the harrows frequently drawing it together in heaps, renders it incapable of being properly burnt till sufficiently exposed and dried again.

Huntingdon, had let a farm on lease for the term of twenty-one years, restricting the tenant from paring and burning. On my opinion being afterwards asked, I recommended paring and burning, followed by proper management. This was immediately attended to; and so well convinced was the gentleman of its valuable and good effects, that so far from restraining, he has endeavoured to enforce it, and set the example upon a farm in his own occupation. Should any reference be required, I have no doubt but the gentleman to whom I allu[illegible] will with pleasure add his testimony to this statement of the fact.

No. XXVIII.

SAND.—*By Mr. Thomas Smith, of Chibness, Oxfordshire.*

I BEGAN the culture of a field of sandy soil, by paring and burning, and sowed it with turnips; but where furze grew I was very unsuccessful; the turnips, although they came up, did not grow to be of any service, but when they shot the rough leaf it turned red, and never flourished, which made me suspicious of the land not bearing oats. I therefore laid upon it fifty load of dirt per acre, which I procured out of a road lying near, that had been mended with limestone. This proved useful, but did not make equal to the parts where the turnips grew well. The oats that were sown upon it the spring following, testifying that there wanted somewhat more to be done, and seeing the road-dirt had been somewhat useful, and it lying very near, I laid on a quantity the winter following, which proved quite sufficient to rectify the soil, as it bore the year after a good crop of Marlborough pease; the next year wheat; and afterwards winter vetches, succeeded by a good crop of turnips in the same year. It was then sown with oats, and laid down as the other, only with the addition of a bushel of ray-grass to the acre. After this process it proved as useful land as any upon the farm, and when I left it was worth a guinea per acre.

No. XXIX.

SAND.—*By Mr. Thomas Baldock, of Burwash, Sussex.*

A PIECE of ground on Burwash Down, a dry bank of poor gravel, sandy top, and the under stratum covered with heath, furze, &c. and very stony, being stubbed and pared, and the turf and stubbings burnt and laid in ridges, was ploughed up, and all the large stones carted off, to the amount of three or four hundred loads, and used for mending the roads. The land was then stirred and turned three times more; fresh stones pulled up and carted off, and now, it being got a good depth (eight or nine inches), the ridges of ashes having been moved, and the ground on which they lay being well and deep-ploughed, and cleared of stones, the ashes were spread over all the ground, with sixteen hundred bushels of very good stone lime. The piece was twelve acres; which was well and deeply harrowed, and lay with a fine deep mould (except the many small stones), like an onion bed. This being the middle of July, it was sown with red and green-rooted turnips, which sprung very quick, as in four or five days they made their appearance above ground; early in August they were hoed, and in the middle of September they were again hoed, and then carefully set out to a distance of about sixteen inches. There happened many good showers, and the weather was pretty good to the end of October. This brought them on apace, and before Christmas they appeared a very fine crop. A trial was made, from which it appeared, that twenty-five or twenty-six tons grew on each acre of ground. These turnips were fed off by sheep, penned on the ground, and in such a manner as to manure the soil as evenly as possible; some few indeed were carted off; the sheep finished feeding off in April; the ground was kept ploughed after the sheep, and the latter end of May, ploughed again; in June, 1000 bushels of lime were spread over it and ploughed in, and turnips sown in the end of the month. They did well; the crop was very large, and fed off after the 13th November till a little before Lady-day, and ploughed after the sheep as before. Early in April the ground was ploughed, and then sown

with barley and seeds; four bushels per acre of barley, and two gallons and half per acre of trefoil. This crop sprung well, both barley and seeds; the barley was rather short, but yet a pretty good crop, $4\frac{1}{2}$ quarters per acre. The barley being cut and carried off, in the beginning of September, the seeds afforded fine keep for sheep till the middle of October; they then were taken away, and the seeds shut up for the winter. In the next spring and summer, they prospered very much, and produced a fine crop of hay, near two loads per acre, which were cut and hayed the beginning of July. The field was ploughed up as soon as the hay was carried off, stirred again twice, and sown with white wheat in the beginning of October, two bushels per acre. This crop turned out well, three quarters and a half per acre. As now I was very desirous to lay this piece down to grass, I chopped up the stubble, which being carted off in November, the field was ploughed up to lie the winter. In March it was ploughed again; and having a pretty good compost, got previously ready the year before, it was brought up in waggons, and consisted of good fresh mould 200 cart loads, of good farm yard dung 250, and about 100 of very rich soil, consisting of scouring of necessary vaults, soil holes, sweepings, scouring of mud-holes from the wash of the town and ditches, besides some soot and ashes. This compost, and 1000 bushels of lime, laid in a heap the autumn before, were both spread evenly over the ground, and well and deeply harrowed in, and the piece sown with barley two bushels and a half per acre, and this likewise well harrowed in. The seeds were then sown, hay, and most other sorts in great plenty. The barley and seeds come up well and quickly, prospered through the spring, and came on surprisingly, and at harvest the barley was a fine crop, six quarters per acre, and seeds such as I had scarcely ever seen any before, so very thick and strong. The field was fed off till the end of October, then laid up for the winter, and in March following it was fed close with 200 sheep till the beginning of April, and then laid in for mowing. In the beginning of July the grass was mowed and hayed, and it was a most capital crop, near three loads of most excellent hay per acre. The after grass was very great, and fed off with cattle, horses, and sheep. This turned out exceedingly good grass ground, and I have taken five summer crops of hay, since the first, and at a medium more than two loads of hay on an acre. One summer the drought checked it much, and the produce was but little better than a load of hay per acre; one good dressing of compost and lime was put on about two years ago. This piece of poor common, though very expensive, has paid, I

think, as well or better than any piece of land of which I have minutely taken notice. The twelve years have cost very near sixty pounds per acre; the crops and seeds may be fairly estimated at £120. per acre. I have little doubt but that most of the commons in the south of England might turn to a good account, if they could be managed in a similar method.

With regard to all clayey cold soils, I am fully convinced, from pretty good experience, that paring and burning is one of the best methods. Fire wonderfully sweetens and improves them, and seeds may be got on them to make a good sward to pare and burn, and this every four or five years. Heavy loams may be treated in the same way; and on light loams, gravels, and sands, turnips and seeds well managed will certainly do; and I think that this management, where plenty of lime can be had, and especially plenty of rich dung and good fresh mould mixed together as great helps, may make most of our poor commons some of the best corn land in the kingdom. It is true, it will be very expensive; yet I think, properly managed, they will re-pay that expence.

No. XXX.

Thin Skinned Warren.—*By Mr. Stephen Kershaw, of Driby, near Spilsby.*

In the year 1782, I entered upon a farm of nearly seven hundred acres of land, which had chiefly been in a warren, and was at that time of very small annual value. A considerable portion of this land was pared and burnt, and found to answer my most sanguine expectation. The crops were full as much more as from the land which was broken up and sown in the common course of husbandry. In order to prove this assertion, I shall mention two or three circumstances of the process and conduct. At Michaelmas 1782, I entered on the largest part of the farm; I had, amongst other lands, a walk containing forty-five acres, valued to me by the quitting tenant, from that time till May-day 1783, at fifty shillings. I mention this to shew the poverty of the land, which was so thin-skinned, that to have

pared and burnt it, was not practicable; I therefore the year following ploughed it up and sowed it with oats, the crop of which was scarcely worth the labour. The summer after, working it well and getting it into good condition, I sowed it with cole, and it produced but a scanty crop. The spring following I laid thirty acres of it down with sainfoin, of which I had good crops for several years. When it was worn out, having a good deal of rough grass upon it, I pared and burnt it, and got a good crop of turnips, considering that it was a very dry season; after which I sowed it with oats, and had a remarkably good crop for that kind of land, more than six quarters per acre. The year following I sowed it with turnips and cole, which were decent crops; eat them off at Michaelmas, and sowed the land with wheat. The middle of February I laid about three quarters of soot per acre, and the latter end of April laid it down with a stone of white clover and two bushels of rye-grass per acre, and harrowed the seeds in upon the wheat; the latter yielded near a chaldron per acre, and a finer crop of seeds could not be seen. I have continued to graze them ever since, and this land has kept three times the stock it was ever known to do before. This clearly shews the utility of paring and burning; in proof of which the thirty acres, so cultivated, part of the forty-five valued at fifty shillings, are now worth from six to eight shillings per acre, for the same period of time.

The other fifteen acres of the best land I worked in the common way, without being able to get any turnips; the crops of corn were scanty, and the seeds did not afford more than a proportion of two thirds for the feed of sheep. In the year 1791, I pared and burnt another piece of sainfoin, about eighteen acres; also a piece of grass seeds twenty-five acres, both of which had remarkably fine crops of turnips. Another piece of land had been laid down but four years; the turf was consequently very tender, and what added to the difficulty of getting it burnt, was, the remarkably wet weather all the early part of the season, which caused great difficulty in getting the sods turned and dried, and made them to break in pieces, so that it was necessary to rake up the scraps with iron rakes, &c.; however, with perseverance, I got them well burnt, and a fine crop of turnips was the reward of my labour. Last spring I sowed the land with barley, which is now nearly all thrashed out, and have not a doubt but that there will be six quarters per acre. This is poor chalky land, chiefly without any mixture of clay; the sainfoin is also chalk, but a much heavier soil, which renders it very bad to burn. The people to

whose management I left that business, expended all the money they were to have, without being able to execute the job, notwithstanding they had great experience in sod burning. I was therefore obliged to continue them, with additional hands, to pursue the instruction I gave them (as they would not submit to be taught while they were their own masters), which was to proportion the size of the heaps, sufficiently large, according to the strength of the soil. By this means almost any land may be burnt, though it were previously judged impracticable. As to the diminution of the soil upon all lands except moor or peat, it is in my opinion impossible. The fire consumes nothing but the vegetable part; I have made the most minute observation, and am well assured of the truth of this assertion. I should also recommend for the first time, paring and burning moor or sedgy rough grounds, by which they will be found much more productive and more clear of weeds, than if managed in any other course of husbandry. It should be observed, that this business be done so early in the spring, that the ground does not get sufficiently dry to cause it to burn. I mean in the first instance, to confine myself to the improvement of land, without having recourse to artificial manures, which in some cases, from local situation, are not attainable. As I conceive the purpose of the Board to be, to bring barren heaths and moors into cultivation, I shall endeavour to explain how land of the above description, may be made productive within itself. When such land is pared and burnt, and a crop of turnips raised, I should recommend two succeeding crops of barley or oats, the straw of which, after being eaten by beasts, will produce as much manure as, when properly laid out, will get a crop of turnips; but if the season should prove so unfavourable that there is not the bulk which might be expected, that will render a deficiency in the manure; only sow turnips in that case, as far as the manure extends, and plant the rest with cole, or else increase the manure to a sufficient quantity by mixing it with fresh earth; the year following, lay it down with grass-seeds and a crop of corn. This I have found to be the best and most productive method of any I have experienced, and it is such as will answer to both landlord, tenant, and the country.

No. XXXI.

Poor Gravelly Heath.—*By Mr. John Wright, of Pickworth, Rutlandshire.*

It is a prostitution of the word to call mine pasture, it being neither more nor less, than a poor light barren heath, and that too of the worst sort that can be well imagined; the spontaneous produce is furze or gorse, some ling, brakes, small shrubby thorns, and briers; and a coarse, hard, speary grass, which cattle cannot eat, although compelled by hunger; and in many places nature and vegetation seem unanimously to have deserted the surface, as scarcely any thing is to be seen; in short, it wears the face of famine. At Michaelmas 1797, I entered upon the above farm; no farm could be in a worse repute, nor did any more richly deserve it; the soil being a poor, sharp, weak gravel, for about six inches, upon an imperfect lime-stone, mixed with earth for about three feet, then generally a perfect rock. This soil has the property of imbibing water so quickly, that after three days successive rain, a loaded waggon will scarcely leave a track. In December in the same year I grubbed and ploughed up two pieces, the one eighteen, the other sixteen acres, for barley. As I intended only to plough it once, it was ploughed early, to receive the benefit of the frost, in order to make it harrow finer. In the beginning of March I sowed four bushels of barley per acre, broadcast and harrowed in; the depth it was ploughed to, was four inches and a half, and the sod well turned down. The produce was about eight bushels per acre; and this failure was chiefly to be attributed to grubs, and wire-worms. Immediately after harvest, I ploughed the eighteen acres, and harrowed in three bushels of rye per acre, the sward being tolerably well rotted. On this piece I proposed eating off the rye with sheep until June, and then sowing it with turnips, on one ploughing, without manure (a very scarce commodity here); but this plan was frustrated by a failure of the rye, the plants being at least three feet asunder; the food upon it was so very inconsiderable, as to induce me, in December, to plough it up, resolving to give it a complete summer fallow, and a dressing of manure: in April it was well harrowed, and ten

cart loads of farm-yard dung were laid on each acre. This was immediately ploughed in, and again harrowed; in June it was reploughed, and sown with round white turnip-seed. The sod was now completely rotted, melted down to a friendly consistence, and garden fine; indeed I never saw a finer fallow. The turnips came up as well as could be wished; and aided by the fineness of the soil, almost every seed vegetated, so that there were plants enough for 200 acres. When arrived in the rough leaf they were harrowed, and then hoed out to proper distances. After these operations, I expected, as did every one else, to see one of the finest of crops; but alas! disappointement is the lot of man; they never grew more; the grub and wire-worm seized them, and they died by thousands daily; nor did the survivors arrive to the size of a pigeon's egg. The ground was in the day time incessantly covered with rooks and crows, which plucked up the plants, for the sake of the insect at the root; but though these did me considerable injury, I did not interrupt their ravages, wishing to be rid of the insects at any rate. The few turnips which remained were eaten by lambs, giving them the eighteen acres all at once, which could not be worth more than five shillings per acre. Now approached the barley seed time, and with it my fears for my crop; early in March it was sown, the ground being in excellent tilth: all who saw it flattered me with the hopes of an abundant crop; though mine were not so sanguine, it was immediately laid down with seeds, it being my intention to sward it over again, and then pare and burn it, as the only effectual remedy I knew of, to destroy the insects. But to return to the barley crop. No sooner had vegetation commenced, than destruction filled the land; thousands were never permitted to shew their heads; the plants came up very thin; and those which did, languished, and died away until the beginning of June; the ground then wore so miserable an aspect, that it resembled a piece of fallow, more than corn, and several advised me to plough it up, and sow it with turnips; my rejection of this advice is not to be wondered at; the profits of the last crop, time had not erased from my memory. What remained alive in June, either bid defiance to the enemy, or else the robber, satiated with rapine, retreated to his cell, and left unerring nature to follow her own dictates. The plants now assumed a deep green, and vigorous colour, a certain indication of health: many of the plants had from fourteen to eighteen stems each, and such ears I never saw; hundreds might be found with forty grains in each (two-rowed barley). The crop is not yet thrashed, but it cannot be less than twenty bushels per acre.

The seeds are a tolerable crop, which I intend mowing, thinking it preferable in many respects; first, by mowing it for soiling stock (should it not be wanted for winter fodder), at the most moderate computation, it will keep equally well double the number; a piece of ground which wants improvement as near the other as convenient, should be appropriated to soiling the stock upon, which I think far preferable to the farm yard, as in this case, the urine is every drop saved, which in my opinion is equal to half the manure. Nor ought the treading of cattle of all kinds, upon soils similar to mine, to be disregarded, as the advantages is very great; rolling with heavy rollers is of service in this loose soil, but by no means equal to treading of cattle, and sheep especially, after the crop is sown, let the crop be what it may, regard being had to the dryness of the soil. From the formation of gravel, and the number and variety of angles every piece is composed of, it is impossible that they can unite without being mixed with earth, or some viscous substance. The most effectual remedy would be marl, 200 loads per acre; or where that cannot be had, clay of any kind. This would be attended with a heavy expence at first, but would amply pay in the end; as in the present state of the soil, the rains run so swiftly through, that they wash the dung and all other dressings below the corn roots, from the want of a firm bottom to keep the water from filtering through so rapidly.

The sixteen acres before mentioned, were ploughed as soon as the first crop was off, about a month after crossed with a great harrow, in February reploughed and harrowed; in the latter end of March ploughed again and sown with white oats, one cast ploughed in, the other harrowed in, and laid down with seeds. The sward well rotted, though not equal to the summer fallow. The crop, as the preceding one, was nearly destroyed by the insects, spaces of eight feet square, without a single plant, presented themselves to the disappointed eye; the produce ten bushels per acre. The seeds, a good crop, kept the following summer in good store condition, three sheep per acre. This soil has such a natural propensity to wildness, that though left down only one year, the spontaneous produce has eaten out the seeds sown, and reigns absolute. Next spring I intend to pare and burn it. The same spring the last piece was sown with oats; I ploughed up another piece of fourteen acres, to sow with oats the first crop, judging that my first failure might be attributed to sowing barley instead of oats, which will endure more hardship, and forage for subsistance better than barley can; the result, instead of being better,

was worse. I did not know here that the insects did one any injury, but the straw was so short and weak, as to render mowing impracticable, being of not much more substance than strong horse-hairs: and many of the shaggy heads did not contain more than three oats. All that could be got off the fourteen acres amounted only, to three quarters; the rest was pastured with stock. I was now so thoroughly satisfied with the impropriety of taking up this sort of land, in this manner, that I resolved never to take up a single acre more without previously paring and burning. In March, 1799, I began grubbing, paring, and burning a twenty-four acre piece of the same sort; in June sowed it with turnips on one ploughing, not suffering the plough to exceed the depth of two inches, lest the ashes should be buried, and out of reach for the turnip to taste. As harrowing this tough sod would have made it lie worse instead of better, the seed was sown, and only bush-harrowed. The plants came up true and well, but after hoeing, the places where the fires had been, grew if possible ten times as fast as those where there had been none, notwithstanding there was no ashes left on those spots. This shews the amazing fertility of fire, and is a lesson to me, and all future burners, to make their heaps as small as possible, so as to enable the fires to cover as much of the surface as may be; for if all the ashes be swept off, and even some of the surface pared off, it will still be superior to the ashes, as I fully experienced. Another advantage arises from making the heaps small, in the quality of the ashes; the larger the heaps, the more intense the fire, and the centre of such heaps get too much burned, as may be seen by the redness of the ashes; those on the outside being perfectly black, and very little inferior to soot. This ground produced a most excellent quality of turnips (as indeed all burnt ground does), value £2. 10*s.* per acre. I afterwards sowed with barley on one ploughing, in March: a finer crop I never saw (quality of land considered); it was estimated at five quarters per acre, throughout the piece, but not yet thrashed; clearing to me as much in one year (and consequently as a proportionate benefit must accrue to the nation), as it would have done by pasturage, in its original state, in a century. The ground also is left in such a state as to promise an abundant crop of oats this spring, with which crop it will be laid down with seeds (red clover). I have an aversion to taking two corn crops, immediately after each other; but in this instance the sward is not sufficiently rotted to be laid down well with the first crop; for this, however, I think I have found a remedy for about 200 acres more of the same sort, in the

course of the next three years, though the thought occurred too late to be used this season. The course is as follows. First year pare and burn, and sow with turnips. Second year, barley; immediately after the barley crop, on once ploughing, harrow in winter tares, to be mown for soiling stock of all kinds upon the same ground; the fence to be kept shifting back, as the piece gets cleared. They may begin perhaps the third week in May, and continue till the seed in the pod is nearly full, perhaps in the beginning of July; what is then unconsumed shall be mown and made into hay, far excelling all others; then immediately on one ploughing, sow with turnips, without manure, though it would certainly be a valuable addition, if attainable; after the turnips, barley, laid down with seeds, either for one year, or permanently. It is scarcely necessary to observe, that this is a most valuable course; here are five valuable crops, and laid down with seeds, in three years and two months, and all may be expected to be good ones, without either fallow or manure. In this rotation, land can get neither foul, stale, nor exhausted; tares are by many thought an inconsiderable crop; but these are such persons as have not been in the habit of cultivating them. All things considered, it is a matter of doubt whether a farmer can cultivate a more beneficial crop, from the ameliorating quality of smothering. Corn thrives remarkably kindly after them. Some may object to corn crops coming so seldom; to this I answer, that the most corn sown is not always the most reaped; but the very reverse; for these two corn crops will, at a certainty, produce more corn, than if every crop had been of that description, whilst the land is left in an improved state, instead of being totally ruined. It may be supposed, that no person would adopt such a ruinous course; yet I have known it done upon land of the above quality, to pare and burn, first wheat, second barley, third oats; three crops the most injurious that can be conceived. The complaint then was, that it would produce nothing; at which no one can be surprised, the system being calculated to ruin the best of soils. I have known many farmers spiritedly stercorate and improve their land to a high pitch, and but few strive to keep them so, which is very easily done by a proper rotation of crops. The mischief is in sowing them with white-corn crops, till they can scarce get two corns for one, and the land again gets foul and exhausted through mere ignorance. It would be much to the benefit of such farmers, and to the public at large, if their landlords compelled them to a certain rotation. The course of tillage I have set down, is, in my opinion, applicable to heaths, warrens, chalk downs, sands, and gravels.

No. XXXII.

HEATH.—*By Mr. C. Wedge, of Westley Bottom, near Newmarket.*

I SHALL mention the treatment of a very poor piece of heath land, which I wished to lay down in sainfoin as soon as possible. I pared and burned it, sowed it with cole-seed, which I let stand for a crop, with a view to mellow the land, and destroy the turf as much as possible. As soon as the crop was off, I made it very fine, by ploughing and harrowing it very well, and as soon as I could procure new sainfoin-seed, I sowed it with rye: I ploughed about half the seed in, and harrowed in the other half—five pecks of rye, and four bushels of sainfoin. This happened to be in the first week of August. I had a very good crop of rye, and an excellent plant of sainfoin. I let the stubble remain upon it all winter, which sheltered it so much, that I turned my cows out upon it in the month of March, and it was an excellent pasture all the last summer. I did not feed it down close, and it now looks extremely well. I cannot finish this account without mentioning an experiment that I made on this piece of land, when I began to pare for burning. I ploughed up an acre in the middle of the piece, and set it with early dung peas, which I got off in time to sow with cole-seed with the other; and I manured it with twelve loads of muck. The result has been, that the burnt part has been twice as good in every crop, and has now greatly the advantage in appearance.

No. XXXIII.

Stone-brush and Light Loam.—*By the Rev. G. Swayne, of Pucklechurch, near Bristol.*

The writer is of opinion, that the best method of breaking up grass lands in general, consistently with the intention of restoring them again to grass in a short time, and with the caution not to exhaust or impoverish the soil, is by paring and burning for a crop of potatoes. * There is no crop the food of man, which is more advantageously cultivated on fresh broken up land, than potatoes; there is no crop more lucrative to the cultivator; † nor is there any with which paring and burning more perfectly agree. The growers of potatoes in this part of the country, are well aware that no manure is better for this root than burnt earth, and the ashes of the sward mixed with it. Some of them even go so far as to assert that it is preferable to stable dung, which has hitherto been considered as the most exellent manure for this valuable root; nor have they any apprehension that burning tends to impoverish the soil. On the light and thin stone-brush lands around Tetbury and Cirencester in Gloucestershire, it has long been customary to pare and burn, not only the grass and sainfoin leys, but even their wheat and other stubbles. If burning impoverished any soils, one would suppose it should such as these, and if this practice was found to impoverish, surely they would not adhere to the custom. It is not the burning that exhausts, but the unremitted cropping, and the improper courses of crops which too often follow that operation.

That combustion in one particular kind of soil tends to prepare or to introduce the food of plants, whatever that food may be, rather than to lessen or destroy it; or, at least to dissipate something inimical to vegetation, seems probable from the following experiment.

* For testimonies and arguments in favour of paring and burning, see Annals of Agriculture, Vol. V. p. 112; Vol. XI. p. 286; Vol. XII. p. 252; Vol. XVI. p. 559; Vol XXIII. p. 356; Vol. XXIV. p. 521.

† For the superior profit of potatoes, see No. 204 of the Annals of Agriculture.

On the 26th of December 1800, a lump of ferruginous yellow clay, just dug up from the subsoil of a piece of wet land which was then under-draining, was put into a coal-fire till it was red hot; it was then taken out; when cold, the outside, for the depth of half an inch or more, was become a red cinder; the central part was black. This burnt clay was immediately bruised with the blade of a strong knife till it was brought to the consistence of coarse sand; a drinking glass was then filled with it, and the next day fresh rain water was poured upon it, till it would absorb no more. At the same time, a similar glass was filled with the same kind of clay in its natural state, and wetted with rain water. Both glasses were then placed together in the window of a room where there was a constant fire. On the 30th of December two grains of wheat were planted in each glass. On the 2d of January 1801, a few white mustard seeds, and a few more grains of wheat were planted in each glass. Both glasses were watered with fresh rain water, as they seemed to require it. On the 10th of January one of the mustard seeds was up in the burnt clay, and in a day or two afterwards the rest. On the 18th one of the grains of wheat made its appearance; on the 20th, two more; and those remaining a few days after; all of which at present appear strong and vigorous, whilst not a single seed has as yet vegetated in the unburnt clay.

The writer indeed has remarked in more instances than one, the beneficial effect of combustion, in promoting the growth of vegetables on red and yellow ferruginous clay, or till; which have long been ranked among the most infertile of soils. Is it that the mineral oil, with which these soils abound, and which in its natural state may be the cause of infertility, is, by the action of the fire wholly dissipated in the case of the clay being burnt red, and converted into carbonaceous matter, when that is burnt to a black cinder?—Or, is this effect produced chiefly from the more free admission of water, owing to the alteration made by the fire in the contexture of the clay? However unable the writer may be chymically to account for it, he is well assured of the fact.

But the following detail of a field pared and burnt, may possibly be thought of more consequence to the present inquiry, than the before mentioned small and unfinished experiment.

A small close of old grass ley, of between two and three acres, the soil a lightish hazel loam of about eight inches staple upon a clay subsoil, underneath which, at the depth of two or three feet, several strata of stones which will burn to a brown

lime, was let in the year 1796 to a common labourer, for the term of five years, at the rate of five guineas per acre per annum, to be ploughed up for potatoes, or any other crop he might choose to raise. In the month of February the turf was pared with a breast plough, and burnt in the month of March; the ashes then spread, and the ground immediately ploughed. In the months of April and May it was planted with potatoes. The summer being rainy, it was found, that the potatoes had been planted too thick. The strength of the fresh ground, manured with the burnt sward, caused them to run too much to haulm. However fifty-six sacks of potatoes were dug from fifty perches of ground. The second year it was again planted, the greater part with potatoes, some part with wheat. The produce was not ascertained. After the potatoes were dug up, part of the ground, exactly half an acre, was sown with wheat in the beginning of December. The wheat was hoed in; that is, drills were opened with the potatoe hoes, at about nine inches apart. When one drill was opened, the seeds were scattered therein as evenly as possible by hand, after the rate of about one bushel to an acre. In making a second drill, the earth hoed thereout covered the wheat sown in the first, and so on. The crop of wheat, owing to the uncommonly wet season, run much to straw; but its produce was sixteen bushels; or after the rate of thirty-two bushels an acre;—a very large crop in that unpropitious season. The rest of the field was planted with potatoes; no account taken of their produce. The fourth season, which was last year, two roods and an half were sown with wheat, the sort red lammas, in the same manner as in the former year; the produce nineteen bushels. A better crop by fifteen bushels an acre than any farmer's crop in the neighbourhood. The straw was purchased by the writer of this essay at two guineas and an half. This is the last year of the term. The tenant would willingly contract for a longer term: but the proprietor is desirous of taking a crop of wheat from it himself. He will probably afterwards let it again for potatoes. The ground has received no other manuring than what a small heap of coal ashes, &c. collected annually at the labourer's door, would afford, which could not be much; the straw was constantly sold.

No. XXXIV.

LOAMS.—*By W. Whiteborne Dark, of Holdsworth, Devonshire.*

As the intention of the House of Lords, and of your Honourable Board, seems to be to produce an immediate supply of bread-corn, perhaps the mode generally adopted in this neighbourhood (and I believe it the only part of the Island where it is so universally practised and so well known), I mean that of paring and burning the turf, may possibly claim attention: it has ever been regarded here as the speediest means of converting old pasture to tillage land, and of producing the largest crops. As a saving of one harvest may in some cases be obtained, this seems to be a very proper and necessary time to encourage the process. The land intended for corn should be pared with the breast plough, or as it is called here, " a spade," (the price is from ten to fifteen shillings the statute acre) as soon as possible after Candlemas; the drying winds of March, will in all probability give an opportunity of burning the turf. The land should be ploughed as soon as the ashes are sufficiently cool to spread. In this neighbourhood we give a manuring of sea sand, dung, or lime; of the former from fifty to one hundred horse loads of 280lbs. weight, of dung about three hundred loads, and of lime from thirty to sixty double bushels; this latter manure is considered by our best farmers as the most eligible (though in the first instance the most expensive), as it does not encourage the growth of grass and weeds.

Such land when pared, if it cannot be burnt in time to sow with barley in the spring, may be in time for turnips, as a good preparation for barley next year, or wheat in the ensuing autumn, for either of which crops we consider it as a most useful preparation.

No. XXXV.

Loam, Gravel, and Rich Sand.—*By Mr. Bennet, of Compton Street, Clerkenwell.*

The method I shall recommend for all loams, gravel, and rich sands, is that which I have adopted on my own farm, and which has carried conviction with it to most of the practical farmers to whom it has been submitted. First, breast plough, and burn the turf; by that means you reduce the vegetable parts only, and the soil is better prepared for the purposes of husbandry; and the land will be sooner fit to receive the grass-seeds to lay down again. I have found by experiment, that earth when burnt returns to its original weight in a short time, on being exposed to the air, &c.; the objection of wasting the soil is then done away. I have with a lime burner made an experiment upon a piece of grass land (strong clay), at the rate of ten quarters of lime per acre against burnt earth, large clay ant-hills of the same field, and it was given in favour of the burnt earth, at little more than half the expence of the lime, and the land was at the same time cleared of ant-hills.

That rotation of crops must be the best, that will produce the most, and keep the land in the best condition at the least expence. I propose a system which I think will answer that purpose, by producing as much vegetable food with forty acres of corn in one hundred acres, as if all had remained in a grass state.

Divide one hundred acres of land into five fields.

Turnips.	Barley, or Oats.	Clover.	Clover.	Wheat.

Two in clover, one wheat, one turnips, one barley or oats, by which means three-fifths would be appropriated to the production of flesh, wool, &c. &c. which I make no doubt will produce more vegetable food than if it had remained in the old turf or grass state. The land, by this mode of cropping, would be enabled to support itself in producing abundant crops. The turnips should be eaten off the

land by sheep; if too wet, pluck them up and throw them over the hurdles; the land where the turnips are drawn off is more exposed to the sun and wind, therefore dries sooner. The hurdles should be moved on dry days. The manure should be laid on the fallows, and ploughed in as soon as possible for the turnip crop, and on the young clover in the autumn, to preserve it as much as possible from injury by frost. The clover should be eaten off by sheep and cattle. If mown the last year, it will sustain the least injury. I think the vegetation cannot be returned too quickly to the soil again, and the stomach of animals the best organ to prepare it for that purpose.

No. XXXVI.

Loam on Lime Stone.—*By Jenkin Wynhall, Esq. of Becknor, Ross.*

I never yet saw a true loam which I think would not, by proper cultivation, produce good turnips; but much experience has convinced me that the sort of which I am now speaking, will produce very large and profitable crops of them: for this reason, I think the course of crops of wheat, turnips, barley, proper for this sort of land.

Paring and burning on this soil, I can speak from experience, will be found to be a most excellent preparation for a wheat crop. I have heard this method objected to, as being injurious to the land after the first crop or two, but I believe that this opinion is not founded on practice.

I have experienced that the effect is quite contrary; the course of crops which I used was wheat, barley, pease, barley; * then laid down. Every one of these crops was remarkably fine, and yielded extremely well. The land has been in tillage ever since, fourteen or fifteen years.

This experiment was tried upon some meadow land which was thrown into an adjoining field; but though the meadow was by no means such good land as the field, yet it is now visible exactly how far the land was burnt; every suceeding crop, even to this time, being better here, than on the other parts of the field, though it

* Notwithstanding the success, this was over cropping.

has been cultivated and manured exactly in the same manner. I have also seen the same practice tried since, on land nearly the same soil, though not quite so good, and the success was the same. For these reasons, I think that no method of converting this sort of land from grass into tillage, is better than paring and burning. Turnips thrive extremely after paring and burning the land; because, by this preparation, it becomes so clean, and is also so very much improved and enriched, that it causes the young turnip plants to grow so fast, that they are soon free from the ravages of the fly, and almost entirely so from those of the slug.

No. XXXVII.

Chalk Heaths.—*By Mr. Charles Wedge, of Westley Bottom, near Newmarket.*

The greatest part of my land, is poor heath on a chalk bottom, the soil white, from three to six inches deep, and in many places near the tops of the hills, the chalk stones are mixed with the little soil there is, quite to the surface, which although it is of a better colour, yet is quite bare, and produces but very little herbage. In other places the soil is deeper, and rather of a red sandy nature: this produces hawthorn bushes, furze, and in some places a little fern: this land is much better than the other, both in its natural state, and when it is reduced into tillage. I had always an idea, that paring and burning was by no means injurious to land, when properly managed; but never, to this day, having seen one course of tillage practised by others that I thought a proper one, and so much having been said and written against it, I determined to act cautiously, as I had a good deal of that sort of land to reduce into tillage, and bring into a regular system of farming, with other old tilled land of the same description worn out, and not easily to be recovered without great exertion.

Indeed nothing can be more injurious than to take, after burning, three, four, or five crops in succession from poor weak, or even from good land, which has been, and still is the practice.

I began first with the best land before decribed, which I ploughed; and with a heavy roll I rolled it down very close, and some part I set with peas, and the other part with oats, after which crop I turned the furrows back without breaking them, run a drill over it, and sowed it with wheat. This answered very well, but best on the pea land: I then fallowed it for turnips, and found, and still find, that turnips will not do very well in this course without muck. With the barley crop, about a peck of trefoil, 3lbs. of red-clover, and a peck of rye-grass were sown, and the land laid down for two years. When this piece was sown with wheat, I burnt a slip of it that I had left on purpose, and sowed it with wheat at the same time with the other. On this land the wheat was better than on the other, and the turnips better without muck; the barley and the seeds were also better. This encouraged me to go on, and I have found it right. It is much the practice to sow this sort of burnt land with turnips, and then with barley, and this is generally followed with two or three crops more before it is laid down. It certainly ought to be laid down with the barley crop; and if it is good land, taken up merely for the purpose of improvement, to get it down again as soon as possible, the course will certainly succeed; but at the present moment this ought not to be done, because a certain crop of wheat will be lost. Nor do I think it either so beneficial for the land, or so profitable to the farmer, to take turnips first. These require the land to be in good tilth, which is seldom the case with one ploughing; and this is one reason why they so often fail; another reason is, that the land is generally ploughed as soon as the ashes are spread, whereby the ashes are all laid at the bottom of the furrow, which generally is about four inches deep, without being mixed with it; and being washed into the chalk with the first shower, a great part of the goodness is thereby lost. Of this fact I have had sufficient proof; all the middle parts of the summer of 1799, was extremely unfavourable for burning; I had when the wet season set in about ten acres burnt; the ashes were spread, lay all summer, and were washed in by the rain till the land was nearly grassed over. After the rains were passed, I burnt some more, and the ashes were ploughed in immediately before sowing; the wheat crop from this land was not so good as the other by more than four bushels an acre. But to return: if a crop of turnips should be obtained, you have such part of the manure from the ashes as is not lost, and the manure from the turnips for one crop of barley. Such lands as are sown with wheat and turnips, must either have muck or the fold, or both, to produce the crops, which cannot be the case.

On the contrary, if wheat is sown the first crop, the ashes make it certain, and turnips are much more certain after the wheat, than they are at first. By this means, both the wheat crop and the barley crop are manured, without either muck or fold (except folding off the turnips), which is bestowed on other lands, and is pushing improvement further than it can be done by any other means, when manure is not to be purchased.

The course that I have pointed out, will more plainly appear by the following statement.

1800 Burnt Wheat.	1805 Wheat after Seeds and Pease.
1801 Turnips.	1806 Turnips manured.
1802 Barley.	1807 Barley.
1803 Seeds,	1808 Seeds.
1804 Half Seeds, half Pease.	1809 Half Pease, half Seeds.

By this course, half the second-year seeds will be sown with pease or tares alternately; the wheat crops will always take the fold, and the turnip land the muck, which, generally speaking, will always secure on white land a tolerable crop of turnips; the fold will not produce the same effect.

After this statement, it requires but little to be said, in order to prove the great advantage of burning this sort of land. The seventh year after burning, is the first time that muck is at all required, as the land is, in no one part of this process, in a state of impoverishment.

No. XXXVIII.

Chalk.—*By Edward Topham, Esq. of Wold Cottage, near Malton.*

With respect to the question, "which is the best method of converting grass land into tillage," I can have no doubt, but that the readiest and best way is by paring and burning. I say this, both from observation and experiment. I am well aware that some scientific authorities have denominated paring and burning "a species of mortgage on the land;" and that landlords catching the sound, have

looked up to this assertion as law. But I have lived long enough to have seen old-fashioned landlords, as well as old-fashioned tenants, all changing their practice by observation and experiment. The fear of such landlords is, that the best part of the land should be consumed by it. The fact is, that the land which is at the top is always the best; but bring the bottom up to the top, and after a certain period of time, and a certain exposure to the atmosphere, the soil that was at the bottom will become the best. In chalk soils, I have had occasion particularly to observe, that ploughing, and turning them up to the air, creates a species of ever-growing soil. On my own farm I have had an opportunity of proving the justice of this remark. When I came to it, I took in a piece of old grass land, for the purpose of using it as a yard, from which I dug away all the soil to the bare chalk rock. Thrice more within six years I have removed nearly the same quantity of soil, which has been made such by the atmosphere, the rains, the frosts, and the footsteps that passed over it. I can have no doubt, therefore, that a much greater quantity of soil will be produced by subsequent ploughings, than can be lost by the thin paring and burning of old grass. Besides, the very burning is by no means lost, because it creates so much manure which goes into the land, and by such manuring produces a larger crop. That crop, in return, supports a larger stock, which again restores to the land all, or more than it took away from it.

For old grass land on chalk, loam, rich sands, peat, moory bottoms, clay in all its distinctions, and fens if not inundated by water, I cannot do otherwise than recommend paring and burning as the best first process to convert it into tillage, as offering to the farmer that immediate inducement which may lead him to undergo the expence of it, and presenting to the country an addition of grain, by an addition of tillage.

The experimental agriculturist, who can bear the loss, may indeed plough in the sward one year to let it rot, and then begin in another year to produce a crop; but this is all lost time to the farmer and to the country. The benefit to the land is all ideal; for if the sward is to be destroyed, is not the quickest way the best? And what is the use of employing two years to do that, which can be effected in one, and produce a crop into the bargain?

The method therefore I presume to offer is, First, to pare the land very thinly in the usual manner with a paring spade, to the depth of about an inch, and then by burning to reduce the soil thus pared off, to black ashes; for if it is burnt to a red colour, they become a sort of *caput mortuum*, and do little or no good to the land.

I apprehend the great question of all lies in a very narrow compass, *viz.* whether paring and burning be the best first process for converting old grass land into tillage? Against this practice, some landlords of the old school (mannerists in agriculture) will perhaps have their prejudices, and conceive their land injured by this method. I am convinced, from actual experience, that such an idea springs from prejudice merely; I hold in my own hands a very large farm; I let some others to tenants; but I am not in any way, or any place a renter of land; I cannot therefore speak from interested motives; what I recommend, I permit to be done; what I advise, I follow myself.

No. XXXIX.

Downs.—*By Mr. Thomas Cussans, Bedhampton Park, near Portsmouth.*

Chalk lands, downs, and sand heaths, and all rough dry pastures, if broken up for corn, should be pared and burnt early in the spring, and sown with turnips and barley afterwards. The above lands should be sown with turnips once in four years. When sown with wheat, it should be after turnips, or a one year's ley, and the red weed will never hurt the crop. I know from experience, by turnips once in four years, and by feeding them with sheep, and consuming the hay, the soil will not waste. If I were a landlord, and the above kind of land were to be broken up, I would have no objection to paring and burning, if the tenant would confine himself to turnip the said once in four years; it would be to the benefit of landlord and tenant; for I know good providers for sheep are almost sure to thrive. I remember hearing my father say, that the land on the north side of Chichester, in the parish of Lavant, was thought to be poor, and not good enough to fatten sheep; but for years past they have sown a great many turnips; and owing to their turniping so much, it is become remarkably good fatting land for sheep, and bears wonderful good corn. Owing to their turniping and feeding them off with sheep, I believe one acre to be worth three in their former state.

Last spring I sowed with turnips without dressing, and 20 acres long since pared and burnt, along side of the same kind of land, which I penned with sheep or dunged the turnips sown at the same time; the turnips struck so far as it was pared and burnt, and the other part failed; so that land after being worn out by sowing, may be refreshed with turnips, owing to the ashes that remain in the land, if burnt 20 years.

No. XLI.

Fens.—*By the Rev. Joseph Scott, of Chatteris, Cambridgeshire.*

To convert coarse fens, moist moors, aquatic mosses, and very rough low grass lands into tillage, and afterwards into fine rich permanent pasture, such lands should be ploughed, burnt, sown with cole-seed, or some other ameliorating crop, and a crop or two of grain and artificial seeds, having been previously well-drained.

All low lands that are intended to be burned, should be ploughed in May, or at least as early in the year as the surface is sufficiently dry to bear the horses to draw the plough; because such lands give a much better opportunity for their being burnt and sown with cole-seed, when ploughed early in the year, than when they are ploughed late in the summer.

But in wet seasons, sooner than miss a crop, fen farmers sometimes plough for cole-seed as late as the middle of June, or even the beginning of July.

With respect to the thickness of the furrows designed for burning, they should always be ploughed as thin as they can, without balking any part of the land; and they are sometimes ploughed where the surface is even, and the sward tender, as thin as one inch, or an inch and a half in thickness; but if the surface is very rough, uneven, and tough, the surface in general must be ploughed much thicker, or the plough will miss more than half the surface. However the rougher, coarser, and more impregnated the surface is with the roots of rushes, reeds, and aquatic rubbish, the less injury the land will receive from the furrows being ploughed thick; but where the land is too soft for horses or oxen to walk upon, or the surface too rough for the plough, such bogs should be pared with a turf-spade, or rather with an instrument made on purpose.

Respecting burning as soon as the sods are sufficiently dry, the furrows or parings should be placed in heaps. In the fens, the labourers or servants make the heaps for burning commonly about two feet or two feet and a half broad, and about twenty inches or two feet high; and the instrument they are mostly made with is a strong hay-fork. As many balks or spots will unavoidably be missed by

the plough, especially where the surface of the land is very uneven, some heaps should always be placed on such patches, and the sward there will be burned as well as that which was ploughed.

In the fens, some farmers have introduced a cheap instrument, drawn by a horse, to heap furrows for burning; but although the use of it may be easily understood, and the operation soon learnt from seeing it worked, yet as it cannot be easily understood by a description, and especially as it is never likely to become generally useful, I shall omit enlarging upon it here.

After the heaps are made, and are sufficiently dry for burning, the persons who set fire to them generally begin in the evening, for such fires burn best in the night; and they always begin to fire those heaps first, that are on that side of the land that is farthest from the wind, because the wind then wafts the smoke from them; for if they were to begin to burn on the windward side, they would be almost smothered with clouds of smoke. And as soon as one row of heaps is on fire, the persons who manage the burning, carry fire with their forks from those heaps that are burning, and set the next row on fire, and so on till all the heaps are in a general blaze. In dry weather the heaps burn very furiously: the fire soon consumes the vegetable furrows, pernicious aquatic seeds, and many injurious insects; it provides also a plenty of the richest ashes to manure the land, which, when spread over the surface, seldom fails to produce an extremely luxuriant crop of cole-seed, which smothers such weeds and seeds as had escaped the burning. As this prodigious bulky crop is always eaten on the ground, it amazingly enriches the land, and leaves it in a fertile state, for a crop or two of grain and artificial seeds. If such surface should again, through a breach of banks, or mismanagement, acquire a sour sward, it may be burned again with care, not only without any injury, but with greater advantage. There is fen land in the parish of Chatteris that has been ploughed and burned several times, that lets this spring at three guineas per acre; a plain proof that ploughing and burning a few times, with good management, does not injure the land. And many other specimens might be pointed out in the fens, where the land has been really improved by being ploughed and burnt several times; but where land has been ploughed and burnt from time almost immemorial, and the tenants have ploughed the furrow deep, and frequently permitted the fire to burn the moor much lower than the land was ploughed, and have repeated such burnings very often, there are instances where the surface is lowered, and the land greatly injured by

such barbarous burnings. Nevertheless, it is not burning in a proper manner that injures rough, sour, aquatic swards, but burning them too frequently, and too deep; for burning rough fens, aquatic moors, and bogs, once or twice in a proper mannner, is certainly the most excellent mode of bringing such rough surfaces and moory swards into cultivation.

The heaps of ashes should always be spread about the land immediately; because if the weather be hot and dry, and the ashes not speedily spread, the fire often burns too deep under the heap-bottoms, and materially injures the land. The instrument used in the fens to spread the ashes about the land, is a piece of board about eighteen inches long and ten or twelve inches broad; the top corners of this board are a little rounded, and the bottom edge is thinned, and a hole is bored into the board about the middle, and a stick about five feet long, and as thick as a small fork, is fastened in the hole. With this simple cheap instrument the ashes are drawn and pushed about the land very expeditiously. When labourers take the work, they have commonly about five shillings per acre for heaping the furrows, burning the heaps, and spreading the ashes. Immediately after the ashes are spread, the most prudent farmers plough the land, to turn the ashes under, and prevent them from being blown away, for it is a great loss to have such valuable manure as the ashes are, blown into the dikes, ditches, and drains. And when the land is thus ploughed over, and the ashes thus turned under, about Midsummer the farmers sow their cole-seed,* and rejoice if they are favoured with the appearance or commencement of rain about the time when the seed is sown. But if the cole-seed does not come up well after the first sowing, the farmers sow over again. The fen farmers very uniformly sow about half a peck, or a gallon of cole-seed, to a statute acre. Of late years, some of them sow a quarter or half a pound of turnip-seed with the half peck of cole-seed on an acre, and it answers very well, especially if the cole-seed misses growing. Sometimes in the fens and adjacent highlands, cole-seed is sown on fallows, swards, and stubbles, without the land being either burnt or manured, and the crops are sometimes very good. When the seed is sown, some farmers only draw a light roller over the land and cover the seed, but many draw a hurdle with bushes under it for the same purpose, and others draw a light pair of harrows with bushes under them over the seed, which covers it very properly.

* Called rape-seed in the London market.

Respecting the young cole-seed plants, they very seldom require either weeding or hoeing; a few plants are sometimes transplanted from thick spots to thin patches. When the cole-seed is a fair average crop, an acre will feed eight large Lincolnshire sheep, or a greater number of the smaller sorts. The sheep are commonly put to the cole-seed about the 11th of October, and have liberty to go into the whole field as soon as they are turned in, because the sheep commonly eat the grass round the outsides of the field, and then the out leaves of the cole-seed, and the hearts and stalks of the cole-seed, last.

A few sheep in a hundred sometimes die of the garget when nearly fat; the best remedy for which is bleeeding; but it is a common custom in the fens, to slaughter such sheep as soon as ever they are perceived to be affected with the disorder. A good crop of cole-seed will commonly sell for two guineas per acre, to be eaten on the land; this year, an average crop sold readily for three guineas per acre. After the sheep has eaten the cole-seed, the stalks are often permitted to stand for seed, and will frequently produce twenty-six to forty bushels per acre; but where the land is designed to be laid down with artificial seeds for permanent pasture, the cole-seed should never be permitted to stand for a crop of seed, because such a crop greatly exhausts the land.

If the best modes of cultivating this most excellently ameliorating crop, were adopted on all rough fen lands, rushy moors, wet mosses, and rough bogs in the kingdom, it would improve the land in a superlative degree, amazingly enrich the tenants, and provide a much greater supply of mutton and meat at the season of the year when it is most wanted for the great metropolis, and all the country markets also. It is therefore much to be lamented, this most excellent crop is not more generally propagated in the united kingdom.

The fen farmers are certainly backward enough in other branches of agriculture, but in the culture of cole-seed, in which they have long had the most extensive practice, they certainly excel most other farmers in the kingdom, perhaps in the world. The most famous place in England for raising this crop (cole-seed) is in the fenny countries." * †

* Modern Farmer's Guide, Vol. I. p. 272.

† Should any nobleman or gentleman, in any district where ploughing, burning, and propagating cole-seed are little understood, wish for only a good fen-plougher, or a servant or a labourer that understands fen-ploughing and burning, and managing cole-seed, if they will only condescend to give the author of this essay an order, he will procure them as good a one as he can, upon reasonable terms.

When the cole-seed has been eaten on the ground, especially after a fallow, the fine fen moory soil is in a most rich fertile state, and never fails to produce a prodigious crop of any grain that is sown upon it. Fen farmers commonly sow oats (five bushels per acre) on cole-seed fallow land, the next after the cole-seed, and not only obtain a very heavy crop, but abundance of grain; for the produce is seldom less than eighty-four bushels per acre, and frequently more. About Wisbeach and Well, hemp is frequently sown next after cole-seed, and the produce is generally forty stone and upwards per acre; but hemp is too exhausting a crop for any land designed to be preserved for permanent pasture. Now that oats sell so well, the bulk of fen farmers sow oats the first year after cole-seed.

No. XLII.

Peat.—*By Mr. Thomas Smith, of Chibness, Oxfordshire.*

About the year 1770, I became the occupier of an estate in which there was some uncultivated land, estimated amongst the rest of a higher value, at four shillings per acre. Part of this land was swampy, full of rushes and rough grass two feet high, hazardous to ride across, and consequently of very little use. Another part was dry heathy land, and covered with short furze, which turned to very little advantage. The first of those pieces described, perhaps may answer the description of land in your fifth statement (peat &c.). The method in which I proceeded with this land, was as follows. I made a cut across all the springs, above the place where the water made its first appearance, sufficiently deep to catch the whole, reducing the cut at the bottom to four inches. I then filled it again fourteen inches deep with small stones, covering them with rushes and rough grass to preserve them from being mixed with earth, and filled up the cut again, which never became faulty while I occupied the farm, which was nineteen years. About the month of May following I had it pared and burnt (or breast ploughed as we call it), at the expense of two guineas per acre, which produced an incredible

quantity of ashes. These, after spreading, were by regular ploughings mixed with the soil to the depth of four inches; and about the fifth of July following I sowed it with (to the best of my remembrance) tankard turnips, which being eat off between Michaelmas and Christmas, with the dressing of ashes it had previously, made it fit for further use. In the spring following I sowed it with oats, and laid it down with eight pounds of broad, and four pounds of Dutch clover to the acre. Both the oats and seeds took well, and fully answered my expectations. In the year following I fed off the seeds with sheep, and the ground carried a stock beyond anything that could have been conceived. But supposing that the ploughings had not continued long enough to sweeten the land, and destroy all the roots of what had been the former produce of the land, I broke it up again at the latter end of March following, and in the beginning of April sowed it with flax, which proved to be the longest and stoutest I ever grew upon any land. I afterwards sowed it with wheat, which was equally productive, and then with oats; after which succeeded winter vetches. I fed them off with sheep, sowing the land again with turnips, and in the spring following with oats and seeds as before, by which means the land became equal to any other part of the farm, and produced a great quantity of dung for that part which was usually ploughed. The land itself had in the whole time only two dressings—of ashes upon the clover, and a dunging for the last crop of turnips.

No. XLIII.

Rushy Pastures.—*By John M'Murdo, Esq. of Milne Head, Dumfries.*

Our limited experience does not entitle us to speak decidedly upon the article; so far, however, as our experience aids us, and from what we have learnt from observation and information, paring and burning does most speedily and most effectually, convert waste, unbroken, heathy, rushy, or benty pastures into arable lands, or lands capable of being cropped in a regular order of tillage, conformably to the natural situation and texture of the soil.

From numberless instances having occurred, of lands being exhausted, and rendered completely effete, by the process of paring and burning, strong and rooted prejudices against the practice have long prevailed.

We are convinced, however, that a dislike to the conversion of waste and unbroken land to tillage, by the process of liming and marling, would be equally just and well founded. In both processes, the roots of the heath, moss, rushes and grasses are destroyed and dissolved, while a dis-integration of the texture of the soil is accomplished by the application of alkaline substances. If therefore the land, after the soil has been thus dissolved and rendered fertile, shall be cropped so long as it continues to yield profitable returns, no wonder that it be found in the end completely exhausted, and for the time rendered entirely sterile. If the land be found more completely exhausted, and more sterile, than after a course of cropping that has followed liming or marling, it is only because the process of paring and burning, accomplishes the more complete destruction of all the roots that bind and encumber the soil, at the same time that it causes the more effectual dis-integration of the texture of its parts. The evil is not in the practice of paring and burning, liming or marling, but in the practice of following up these processes, by a severe and injurious course of over cropping. The quantity throughout the kingdom of wastes, and unbroken lands, capable of being converted to tillage, is very great. The usual process of converting such lands to tillage, by either breaking up, fallowing, liming, and at the third year cropping; or by liming on the sward, and after two years breaking up and cropping, is in both instances very expensive, and very circuitous. To fallow before liming or marling, is the mode found most certain of success, but it cannot be effected in less than two summers, and that too with much severe labour. The liming or marling follows, and a crop is obtained in the third year. Where the lime is spread hot upon the sward, it is requisite that it remain in that state two seasons before breaking up; if broke up after remaining only one season, we can state from experience, that the crop will fail. If broken up after laying two seasons, the tilth will be extremely coarse, and although it may produce two good crops of oats, yet these must be followed by a summer fallow, with either dung or a second liming, before the land can be sown out for pasture.

Our information induces us to state a process, by which rough unbroken land may be converted to arable and regular pasture, without the heavy expense of furnishing lime or marle, or of working, for two seasons, coarse fallows; and where

in both instances the land, after being twice cropped, is left in the farmer's hands fit only for a second fallowing, liming, or dunging. The process is as follows.

In the months of April and May, pare and burn; after the ashes have been equally spread upon the surface, the land is to be turned over with a very ebb furrow, and at the proper season to be sown with turnips broadcast. From the entire absence of root weeds, they will require little care in hoeing or dressing. This crop is to be consumed upon the ground, by folding sheep upon them in flakes. So soon as the land is cleared of the turnips, it is to be ploughed with a good furrow, and so to remain until the season for turnip-sowing again arrives. If well worked and laid into drills or stitches of the usual breadth of two feet and a half asunder, the dung derived from the sheep that consumed the first crop of turnips, will give a superior turnip crop the second season. The second crop of turnips is, like the first, to be consumed by folding sheep upon it in flakes; that done, the land is to be ploughed and laid into ridges for a corn crop, which is to be either barley or oats, according to the quality of the soil and situation of the lands. The lands, if rich and well sheltered, ought to be cropped with barley; if otherwise, with oats; in either case to be sown off with grass seeds for pasture. Under this process, the smallest possible expence is incurred, and the lands, at the end of three seasons only, are thrown into pasture in high condition, while in the course of the process, one valuable corn crop, and one valuable crop of turnips, have been obtained, together with a less valuable crop of turnips; which last, however, may be sufficient to defray all the expenses of tillage attending it, over and above that of the paring and burning. The expense of preparing for the second turnip crop, and for the corn crop, will amount to no more than the price of ordinary light tillage; and the lands, from being thrown into grass in high condition, will not only afford abundant and profitable pasture, but at the same time will be ready, when broken up at a future period, to afford luxuriant corn crops. With respect to the process of paring and burning, the expense, when executed in the ordinary method, by hand labour alone, is to be sure not inconsiderable. The price will necessarily vary in different districts, according to the customary price of labour; but from the present situation of things, the price throughout the kingdom would not, upon an average, amount to less than forty or fifty shillings per acre. When executed by hand labour alone, the process, for many obvious reasons, will be but imperfectly performed. It is the intention of the writers of this essay, to adopt a practice

recommended in Mr. Hale's book, entitled, *A complete Body of Husbandry*, a work published in the year 1756, where, in chapter xxxix, the process of "burn-baiting" is fully described, and a species of horse-plough to be used as a substitute for the paring spade, is described and warmly recommended. The reasons for adopting this plough are so plausible, and apparently well founded, that the most sanguine hopes are entertained of its success. If successful, they intend to follow the paring and burning, by a repetition of turnip crops as already stated. The soils upon which they intend to work, are, dry red loams hitherto unbroken, and at present covered with heath, yellow moss or fog, and coarse benty grass.

No. XLIV.

Rough Uncultivated Ground.—*By Digby Legard, Esq. of Garton, near Malton.*

Paring and burning, when regard is had to the subsequent cropping, is advantageous, because it ensures generally a crop of turnips, the foundation of all good husbandry. Turnips are esteemed justly the best of all meliorating crops, for the following reasons, *viz.* the number of both winter and summer ploughings, that the land receives in preparing for this plant; the hoeing, in order to render perfect what the plough has left undone; the mellowness, which the land acquires from the shade and confined air, produced by a luxuriant crop, and the warmth and manure which it receives from such crop being eaten upon it by sheep. Paring and burning may be of great advantage in two very different situations; in hilly, exposed, uninclosed tracts, where manures cannot be procured; and in rough, uncultivated ground, producing coarse, wiry, harsh grasses. In both, it ought to be used with great caution and discretion, and they who practice it should constantly remember, that by this operation they have reduced their soil in some degree, which they must endeavour to restore by every possible means; and that they have certainly forced their soil to unusual exertions, which, if not properly directed, will very soon exhaust it. Perhaps, it may be compared to a fortune in ready

money, which in careful and prudent hands will produce riches, but is soon wasted by the negligent, or the squanderer. The above described, are the only situations where paring and burning is admissible; but in all tender soils, where the surface is even, and the blade of grass sweet and close, it ought never to be permitted.

Grass land ought to be ploughed at the first, to the depth of the swarth, and in the second year, a sufficient quantity of the sub-soil to be turned over it; but this quantity will be best ascertained by the judicious farmer, according to the nature of his field.

In all light dry soils, the advantage of eating the turnip crop upon the land by sheep, is very great, and therefore should invariably be practised. The small waste in the consumption of the crop, is sufficiently made up, by the warmth caused by the animal, and the consistency which the land acquires by being trodden. The quantity of manure will be the same, or rather greater, if the crop be carted off, but it will be deposited in a different place, and not in the land, which is the subject of the present enquiry.

No. XLV.

Old Pasture.—*By W. Trevilyan Esq. Netherwitton, near Morpeth.*

Paring and burning is my constant practice, previous to breaking up any old pasture, meadow, sward, or heath, as it destroys the wire-worm, which has invariably done me, without this process, as to grain, turnips, &c. &c. damage almost incalculable. The ashes ought to be spread immediately, mixed with four tons of clod lime per acre, if it can be obtained at a reasonable price, reduced to a powder (not effete). These will form so strong an alkaline lye, as to destroy all such animals, grubs, &c. with their sperm and ovaria, wherever it can reach, far beyond the plough. In proportion to the quantity of animal substance thus dissolved, so will be the increase of manure.

No. XLVI.

DEPTH.—*By Mr. John Martin, of Naseby, near Welford, Northamptonshire.*

BY paring thick, some have imagined that the soil must be wasted, but there is little danger of it here, as it is generally deep of its kind. But, I will venture to affirm, that this is not the case upon any kind of land, where the operation is necessary. The tops and fibres of the roots are all dissolved at once by fire, which would be the case, in time, by the process of tillage, if not burned; the earth is calcined, and apparently reduced in quantity, as ashes, while dry; but when spread abroad, and rain has fallen, it expands, and becomes as great in quantity, as before burning. This might be proved, was it possible to separate the vegetables, root and branch, from it immediately.

IV.

MANURING.

No. XLVII.

LIME.—*By Mr. Joseph Atkinson, of Swarland, Northumberland.*

I HAVE applied lime, in its quick or caustic state, to newly broken up lands of various qualities, in every proportion, from one hundred to seven hundred Winchester bushels of shells per acre; and the uniform result has been, that the produce has been greater, whether of corn or grass; and, every other circumstance being equal, the greater the subsequent profits, where the greatest quantity of lime was applied. I therefore consider myself justified in recommending lime, in its quick or caustic state, in the most unqualified manner, as the most powerful menstruum in the reduction of crude indigested lands; and in such quantity as circumstances, and the means of procuring it, may dictate. With me it costs, carting included, five shillings a load, or two pence half penny per Winchester bushel, measured in the shell, from the kiln. It may be still farther advisable to state, that it is only to such newly broken up, crude, undigested lands, that I would recommend lime in this state, or in this quantity. To lands that have been long in tillage, and which are previously saturated with calcareous matter, I would not apply quick lime, but its carbonate, or lime in its cool, effete state, and that only, when mixed with dung or some other animal or vegetable substances, in compost.

No. XLVIII.

Lime.—*By Mr. Stephen Kershaw, of Driby, near Spilsby.*

If recourse is to be had to artificial manure, confining the management of the land to its own internal resources (coals excepted), lime is to be mixed as soon as burnt, with fresh earth, previously laid up in a heap, in alternate layers; lime five or six inches, the earth nine or twelve inches. After it has laid six or eight weeks, turn it over to incorporate it, and soon after this performance, it will be fit to lay upon the land. Dressing out of ponds, moats, and ditches, is excellently good to be mixed as above. I have had fine crops of turnips by this method. I have found lime to do good upon all chalky soils, both light and heavy, but it is not to be depended upon for a crop of turnips alone, but will be found serviceable to corn and seeds. Lime is more productive in sandy soils, and such as are subject to produce what is called fingers and toes in turnips. Marl, white and rich blue clays, are excellent improvements of poor sandy sedgy soils. Soot is a very good thing for wheat, upon poor heavy soils, laid on at Candlemas about three quarters per acre, which will produce an additional quantity from six bushels to a quarter per acre; after which, the ground may be laid down with grass-seeds to very great advantage, as the pasturage will be found very productive.

No. XLIX.

Lime.—*By Mr. John Wright, of Ranby, near Retford.*

When I first began the cultivation of the farm I now reside upon, being sand land, I found a part of it in its original state of forest. After burning off the furze, and preparing it for lime by ploughing, &c. I spread two chaldrons per acre of lime over the whole, except two strips of land, ten yards each in width, extending across a field in different directions, one being from north to south, the other

from east to west, so as to embrace all the various qualities to be found in the soil; the consequence was, that where the lime was spread, my success was equal to my hopes, but the two strips of land unlimed were visibly different, even at a great distance, for they equally failed in every crop, *viz.* turnips, oats, and seeds.

Not knowing then, so well as I now do, that lime, however good it might be in such cases, should be nevertheless used with a sparing hand; but flushed with the success of these experiments, I increased the quantity from two chaldrons to four, upon a fallow, which had been limed the fallow preceding, and I failed completely, for I had neither turnips nor corn, nor do I think the field has perfectly recovered to this day.

But upon land which has been long in a course of tillage, lime has by no means that good effect: for a few years ago I took a farm of the same quality as the above, but which had been sometime in tillage; on one of the old tilled fields I limed, being informed that it had not been limed for many years. In the middle of the field, I left one land unlimed; and the unlimed land was equal to the rest in turnips and corn; and though the seeds had rather a fresher appearance where limed, yet in the corn, since the seeds, there was no difference. From the result therefore of experience, and also from the corroborating information obtained from very intelligent men, I shall venture to draw the following conclusion, as to the actual properties of lime. Lime, though perhaps not possessing one particle of fertility in itself, as a manure, has a stimulative power of enforcing to action, the food of plants, found in land long unused to tillage, or lands made fertile by high management; for I am thoroughly satisfied in my mind, not only from my own experience, but from all the information I have been able to collect, that lime upon exhausted land, is not of the least service.

That there is great difference in limes, I admit, but my notion is, that they all act upon the same principle, some in a greater and some in a less degree. If the far-famed Derbyshire lime be brought in contradiction to this, I have only to say, that I have observed its wonderful effects upon its own heaths, and yet believe its principle of action to be the same as above stated; for at the time it is destroying the plants to which it is an enemy, it may be exciting to action the food of those plants which flourish so much in consequence of liming.

On the first fallow, after old pasture is broken up, I will venture to assert, that lime has not its equal in real good effect, whether the soil, be clay, loam, or sand,

including all their distinctions. If it be intended to lay down with grass-seeds, no other manure ought to be added, for it would endanger corn being too rank and lodged, so as to smother the seeds.

No. L.

Lime.—*By Mr. W. Jones, of Foxdown Heath, near Wellington.*

The manure I would lay on should be, as to quantity, proportioned to the quality of the land, but as to the kind, lime mixed with earth taken up at about six or eight feet wide from around the hedges, where it will be constantly collecting in ploughing and harrowing; but I would use no dung, which should ever be reserved for pasture lands only, as it contains worms which oftentimes injure the wheat, and it is apt to make it shoot up too high, with a weak stem, which seldom stands up till harvest. Then instead of being cut down, it is but too frequently cut up from the ground with a luxuriant stem and a light ear; whereas, the lime renders the stem stiffer by more gradual growth, and at the same time destroys the worms. A remarkable instance of this occurred to me in the year 1784, when I had the lime and earth manure thrown abroad in order to ridge up a field; but before I could do it there fell a very heavy rain, which so washed the lime, that the surface of the field was white with the lime-water: the effect of it, however was, that the quantity of the common red earth-worm that issued from their holes, and lay dead, exceeded all credibility. This land lay till it was dry, before I ridged it up, and the produce was twenty-eight bushels per acre. Another very material circumstance, in addition, is, that the quantity of wheat is greater, and the quality better, even supposing both to stand up equally well. It is an acknowleged fact, that wheat produced from lime manure has the bran thinner, and the grain heavier, than that produced by dung. Wishing to ascertain the supposed difference in weight, I have referred to a very intelligent baker, who assures me, that the difference is not less than two pounds on a Winchester bushel of about sixty pounds weight, so that this constitutes a difference of a thirtieth part of the meal in favour of lime.

No. LI.

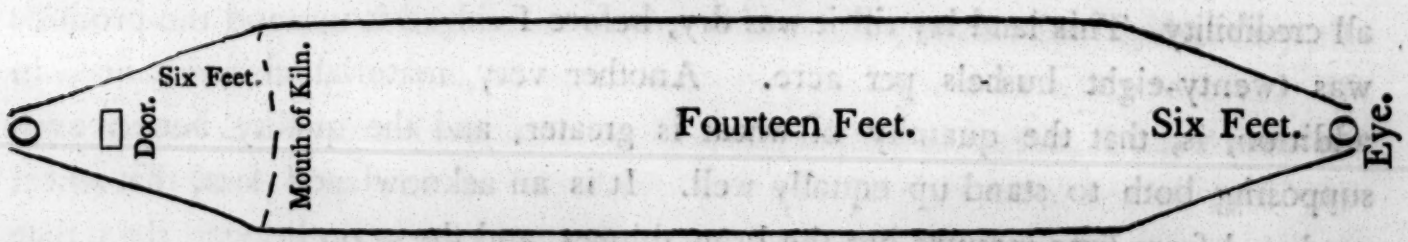
Sort of Lime.—*By Mr. Thomas Baldock, of Burwash, Sussex.*

Our lime, for wheat upon fallows, is either stone, or chalk. The chalk lies near Lewes, which is twenty miles from Burwash, and therefore comes very dear: the stone for lime is dug and burnt in the parish, at about two or three miles from Burwash town. The Earl of Ashburnham burns from sixty to eighty kilns annually, which kilns hold a thousand bushels. Many other kilns burn lime about us, and being cheaper than chalk lime, is the sort generally used; yet some of our best farmers have made use of much chalk lime within these few years, and generally approve of it on their heavier lands.

No. LII.

Lime Kiln.—*By T. G. Rawson, Esq. of Cardrington, near Athy, Ireland.*

In lime burning, I have made considerable improvement in the saving of fuel, by building my lime kiln according to the following sketch.



This kiln is made twenty feet high; at the bottom, a metal plate with holes is placed at one foot in height, intended to give air to the fire; over this plate, the shovel runs which draws out the lime. The sloped sides are six feet high, the breadth at top of the slope is eight feet, the sides are carried up perpendicular

fourteen feet, so as that every part of the inside, for fourteen feet, to the mouth, is exactly of the same dimensions. On the mouth of the kiln a cap is placed, built of long stones, and expeditiously contracted, about seven or eight feet high: in the building of the cap, in one side of the slope, the mason is over the centre of the kiln, so that any thing dropping down will fall perpendicularly to the eye beneath. He is to place an iron door of eighteen inches square, and the remainder of the building of the cap is to be carried up until the hole at the top be contracted to fourteen inches. The kiln is to be fed through the iron door, and when filled, the door close shut. The outside wall must be three feet at the bottom to batter up to two feet at top, and made at such a distance from the inside wall of the kiln, that two feet of yellow clay may be well packed in between the walls, as every kiln built without this precaution will certainly split, and the strength of the fire be thereby exhausted. At eight feet high from the eye of the kiln, two flues should be carried through the front wall, through the packed clay, and to the opposite sides of the kiln, to give power to the fire: with this kiln I have produced one-third more lime from a given quantity of fuel; and stones of bad quality will be here reduced into powder, and may be put into the kiln without the necessity of being broken so small as is usual. As many situations may not admit of building a kiln twenty feet high, as other situations may allow of its being built thirty or even forty feet (for it cannot be made too high), the diameter of the kiln should be proportioned to its height.

For several years I have made use of a small kiln in an outside kitchen, the height nine feet, the diameter three feet and a half. In the sides of the kiln next the fire, I had three square boilers placed, one of them large, containing half a barrel, with a cock, which supplied the family with constant boiling water; for the two others, I had tin vessels made to fit inside with close covers, in which meat and vegetables with water were placed, and put into the two smaller boilers which never had any water, but had close covers. The tin boilers were heated sooner than on the strongest fire, and when the meat, &c. were sufficiently dressed, the whole was taken up out of the metal boiler. At one side I had an oven placed for roasting and boiling meat; the bottom was metal of twenty-six inches diameter, and one inch and a half thick; a flue from the fire went underneath. Even with the bottom of the oven, a grating nine inches square was placed, which opened a communication between the oven and the hot fire of the kiln. The height of the oven was fourteen

inches, shut close by a metal door of eighteen inches square, and the top, level with the mouth of the kiln, was covered by another metal plate of half an inch thick, on which was placed a second oven; the heat which escaped through the half inch plate, though not near the fire, was sufficient to do all small puddings, pies, breakfast cakes, &c. &c.

The meat in the large oven was placed on an iron frame which turned on a pivot and stood on a dripping-pan, and was turned by the cook each half hour.

Over the kiln I had a tiled stage for drying corn, and a chimney at one side, with a cowl on the top, carried off all steam and sulphur: a large granary was attached to the building. The lime, if sold, would more than pay for fuel and attendance; and I have frequently had dinner dressed for fifty men, without interfering with my family.

No. LIII.

Sea Weed.—*By Mr. John Sherrif, of Haddington.*

Sea weed, which is a capital manure for any land, may often be procured at little or no expence, but the cartage, for this soil, from its contiguity to the sea shore. Crops almost incredible of turnips, barley, clover, and rye have, to the writer's certain knowledge, been obtained on an extensive tract of the most miserable benty wastes and poor rabbit warrens, by the powers of this manure, which twelve years ago were not worth three shillings an acre. The bent was torn up by the common swing plough, burnt, and the ashes spread: the soil was then manured with the sea tang, as much as could be ploughed in. Turnips were immediately drilled, and rolled to prevent blowing: this crop was succeeded by rye or barley, and that by red clover and ray-grass. On the clover stubble, and sometimes after the turnip, plenty of tang was again laid, the lay ploughed down and sown with oats, barley, or rye, and frequently with turnips, which, in this way, have succeeded admirably on the ley with one ploughing. If a tract of this kind of soil, with similar advantages, is proposed to be converted into good pasture, it will at once be perceived that the

metamorphosis is extremely simple, and the practice no less profitable. This land has improved two thousand per cent. and enriched the cultivator at the same time. Without the introduction of turnip, and the most judicious and perfect culture of that *sine quâ non*, by a most skilful improver, the writer does not think this waste could ever have emerged from the chaos of sterility, in which, from time immemorial, it had been involved. Notwithstanding the tang, if the turnip had not been eaten on the land with sheep, no such effect would have followed.

No. LIV.

MARL.—*By* ——— ———*

I KNOW a farm of about three hundred acres, which, about twenty years since, let at fourscore pounds per annum, on which no person could live. The soil was one continued stiff clay. A person possessing some property took a lease of it, previously making himself acquained, that at an easy distance below the surface, good malm (a sort of white clay) could be obtained in any quantity. I cannot pretend to say what quantity thereof he laid per acre, but I observed it very considerable; I should suppose full sixty tons. The money expended this way, and in rooting up hedge rows, and making drains and ditches, must have been full one thousand pounds; but it was well applied, for the produce ever since has been full three times as much per acre as it was in its original state. The quality of malm will be best proved by common vinegar: dry a small piece, and immerse it in a wine glass of vinegar; if it instantly begins to ferment and extracts the acid, then it may be depended on to answer a valuable purpose.

* A reward was voted to the Essay from which this extract is taken, but no letter or mark came with it.

No. LV.

Clay Marle—*By Mr. John Kiddle, of Marsham, near Aylesham.*

A heath was inclosed of a very inferior quality, which had never produced any thing but brakes and fern; such a soil as in many parts of this kingdom would be thought incapable of any improvement. On one part of this land was found a most valuable bed of marl mixed with veins of clay, in colour white, but of a soft meliorating nature; the tenant, who was an active man, embraced the opportunity of improving his land with avidity, and with all the assistance he could procure, immediately covered his part of it with sixty loads on an acre, in the winter season. The land had in the summer and autumn preceding been ploughed two or three times. It being in the vicinity of the city of Norwich, he was able to procure a sufficient quantity of muck to cover it, at about twelve loads on an acre, and he then sowed it with turnips. The summer and autumn being moist, the turnips were equal to any of the old inclosures adjoining; the crop of turnips was fed on the land; the succeeding year it was sown with oats, which were allowed to be equal to any in the neighbourhood. The tenants on the opposite side of the heath, having no other resource (nor I believe not taking the pains to try for it) than the marl which they had used for their old inclosures, and which was of a chalky nature, manured theirs with the usual quantity, of about twelve loads on an acre, but manured it with the same sort of muck which was used on the other, and sowed it with turnips, which were fed off on the land. The difference between the crops on these adjoining lands, with a similarity of soil, was astonishing; and to those who saw them, and were strangers to their management, not to be accounted for, as the turnips and barley were not of half the value on the last as on the first, and every succeeding crop of the first exceeded the others. This, and many other instances, if rightly observed, shew the strong necessity of procuring, if possible, clay or marl of the clayey nature, for such soil, even if brought from a considerable distance, as the land is by such means rendered of double its value. But if no such manure

can be procured, and chalky marl offers itself, it must be used at all events, as without a staple manure, such land will never admit of being converted into tillage with any advantage to the cultivator. Without clay or marl, the land of such quality acquires no firmness, and no turnips can be grown on them, as in the early part of autumn they will be subject to the " anbery," and after being infected with it, they never make any progress in their growth, nor are of any use for the cattle, particularly those that are in a forward state.

No. LVI.

MARLE.—*By Mr. Thomas Chatterton, of Wapplington, near Pocklington.*

ABOUT eight or nine years previous to the year 1792, the writer was fixed upon a farm in a different part of the country, distant about 100 miles, from that in which he now lives, of a different nature in soil, &c.; he entered upon it in a wilderness state, and at the end of eight years, with great reluctance, left it like a garden. The farm contained about forty acres of different soils, but the greater part of it was a strongish gravel, which in some former time seemed to have been mixed with a weak sandy soil. There was a pit in one field, in a corner of the farm, more than two acres in extent, and in depth ten or twelve feet; the writer was persuaded something had been carried out of it for the use of the farm; yet upon the most minute enquiry he could not gain any precise information respecting it. Every one supposed that clay had been got to make bricks, the field being all clay; but this appeared very unlikely to have been the case, from the situation of the field, and there being not the least vestige of a brick kiln to be seen in the pit. The writer, therefore, searched into the pit, and found it to contain marl of different qualities, but in general very good, which immediately convinced him that some better farmers, in former ages, had been at the expence of conveying it from the pit over a great part of the farm. The executing of this business now, could not be performed for the sum of two thousand pounds; a plain proof that agriculture was not then in so poor a state as many have supposed. How long a time the use of

marl had been discontinued there, cannot be ascertained, but from the appearance of the country round, it must have been many centuries. Numbers of similar pits are to be found in the neighbourhood, but it was not known to any inhabitant of the country, why they had been sunk, or what they had contained; nor was it known that there was any such thing as marl in that part of the country, until the writer had made the above discovery. He, by seeking about the country, found many large pits, as above mentioned, several of which had very ancient oaks growing in their bottoms and sides, plainly marking their antiquity. The above mentioned farm having, at some period of time, been most of it covered with marl out of the said pit, from a weak sandy gravel, became a rich loamy gravel, to the depth of ten or twelve inches, *viz.* as deep as was within the power of the plough to move. The farm had been for some years, previous to the writer's entering upon it, occupied by tenants of confined knowledge in their business, and had been made in many parts weak, and most parts excessively foul, by weeds of almost every description, but twitch or quicks prevaded the whole. A considerable quantity of dung being upon the farm at the writer's entry upon it, and as it lay within a convenient distance of a market town, where dung could be had, he undertook to fallow and cleanse about twenty acres old tilled land the first summer, dunging it for turnips; which all succeeded well, and brought good crops. This enabled him to get some good corn the year following, which being followed by a good crop of seeds, was a great strengthening to the whole farm in future. The year after his entry he began with the marl; the first piece he marled was a piece of old mowing land, which lay high, was near a sharp gravel; it had but a very dry, poor sward, and produced but a small quantity of ordinary hay. He covered five or six acres with marl, laid about forty loads upon each acre, and when spread, was very attentive to catch a proper opportunity to harrow it small, as it seldom is in a fit state for that operation but upon a change of weather. The first year the improvement did not make much appearance, but the year following it was astonishingly great, both in the quantity and the quality of the hay, and remained so as long as the writer occupied the farm, which was about six years after, when he left that field greatly increased in value. The year following, he laid about the same quantity per acre, upon a few acres in the middle of a field that was then under the plough; it was spread and ploughed in, when oats were sown; the crop upon the marled part was superior in strength and richness to the other part of the field, yet it did not seem to have

undergone so great a change as the grass piece above mentioned. Perhaps one reason might be, the piece sown with oats had never been marled before; and the other, from the strength and firmness of the soil, appeared to have had marl laid upon it sometime, as the top soil was much more free from pebbles, though underneath there was a very strong gravel. When the field was in grass-seeds after the oats, the colour of the grass was strongest and richest, where the marl had been laid; but as all was pastured together, no difference could be ascertained in quantity of produce. Several other fields were marled while in tillage with about the same number of loads, all which answered very well under the plough, seeded well with grass, and became rich pasture; but where the land was most gravelly and sharp, the greatest change took place.

The writer was not long enough upon the farm, fully to prove what advantage would arise from his mode of marling, but he doubts not that his successor has, by entering into his labours, tasted the sweets, as there was every appearance of durability in the new made improvement.

Bone Dust.

Another experiment which the writer made while upon the above farm was with bone-dust, or crushed bones. He laid four quarters of crushed bones per acre upon one side of a field, which had been broken up the preceding year for oats, and that summer prepared for turnips; the remaining part of the field was dunged. The whole missed a crop, from the fly or slug destroying the plants; they were sowed a second and a third time; the last sowing was not destroyed, but it was so late in the season that no part of the field could get to perfection, none being of much greater size than a goose egg, and therefore little or no difference was seen between one side of the field and the other. But the year following, when it was sown with oats and mixt grass-seeds, the part where the bone-dust was laid had greatly the superiority in colour, quality and quantity; and ever after as long as the writer occupied the land, the grass marked to an inch how far the bone-dust was sown. The soil of the whole field was a weakish gravelly loam.

Another experiment with the same kind of manure, was made upon a meadow which lay low, and near a small river, and which in great falls of rain was flooded. The soil was a deep loam, the land sound and dry, except in a very wet season,

yet the herbage was rather harsh and sharp, owing perhaps to a coldness below the surface from its low situation. It produced but little hay, and that not of a good quality, though from the appearance of the soil, &c. much better might have been expected. Upon a part of this meadow was sown the same quantity that had been sown upon the tillage, *viz.* four quarters per acre; they seemed to go well into the sward, so as to disappear, but when the mowing season arrived, to the writers's great surprise he could not perceive any advantage from the bones; yet not being willing to give up the experiment, he the year following sowed the same quantity he had done before upon the same land, not being sure that four quarters were enough; the result was, that he could perceive the grass rather richer in quality, but very little increased in quantity; the meadow was continued in mowing so long as the writer occupied it, which was about six years, and he never experienced much variation of the bone-dressed land from the remaining part of the meadow. He had seen but little more advantage arising from bone manure upon another person's meadow, which had been well manured with it, upon a different soil. These circumstances made him conclude that bones ought to be mixed with the soil by ploughing, and laid upon dry land, where they are of great service, and perhaps the most durable of any manure whatever, except marl, which in some instances is better.

The distance of time since the writer made many useful experiments of different kinds, *viz.* in cleaning, enriching, floating, underdraining &c. upon the above farm, prevents his detailing them exactly, he will therefore only make a general observation or two upon the whole. First, he found that it was in vain to attempt the improvement of land, either by ploughing or manuring, until it was laid dry by under-drains, or some other means, whatever the nature the soil might be of. Secondly, he found ploughing deep and sowing oats early, *viz.* the middle or latter end of February, of great advantage upon dry land, when the season would permit; but not upon cold or wet soils, as it generally starved the corn, and produced a thin crop. Thirdly, he always found pasturing grass-seeds, chiefly with sheep, but not too great a stock, so as to force them to scoop out the heart of the clover roots, was the best way of promoting a strong sward, as well as of strengthening the land. Fourthly, he has found by long practice, that the chief part of the dung made upon a farm ought to be laid upon the old sward, or on the seed-grass, and not upon the parts in tillage. By this method the sward is strengthened and enriched, and when it is thought proper

to break it up again, it will be found as rich as it ought to be for oats or barley. The sward will, when decayed, together with stubble, make the land sufficiently strong for turnips, and the turnips being eaten off with sheep, will prepare it for a spring crop of either oats or barley, with grass-seeds. This, if eaten by sheep afterwards, will prepare the land for the same course of crops again. The quantity of grass-seeds to be sown it is not easy to determine: much has been said upon the subject by many writers, therefore it is only necessay to say that enough should be sown to produce a good sward, without lavishment. This will generally be found to be from 14lbs. to 20lbs. of mixed seeds, with two or three pecks of rye-grass, per acre.

What is said above, relates chiefly to free open soils.—One observation will not escape the reader's notice, which is, that in about the course of every seven years, two crops of corn are taken from the land, leaving it in a better state than it was before it was broken up. This may appear a little mysterious at first sight; but when it is considered, that the rotten sward may very reasonably be supposed to possess more vegetable support than the two crops of straw have taken away; and that by opening the soil, it has imbibed from the air some additional strength, the mystery vanishes. The writer has repeatedly experienced this rotation of crops in his former situations, and hopes he shall make it appear beyond a doubt, that the above system has wonderfully improved the farm he is at present fixed upon, as well as been profitable in the doing. It may be asked, what has been done with the dung, accumulated from the two crops so taken from the land as above, if none was laid upon the tillage land? In answer to which, the writer has endeavoured to strengthen his meadow land as much as possible, quantity and quality of hay being a desirable object, and where there appeared any weakness in the seed-grass, as there generally does in some parts of almost every piece of land, either from throwing down the lands, or shallowness of soil, &c. he has scattered some dung upon such places while in pasture. He has also generally set three or four acres of potatoes upon rough poor land every year, which could not be done well without dung, and it has been a very profitable crop, particularly the two last years.

No. LVII.

Burning Stubble.—*By Mr. William Curtis, of Lynn, Norfolk.*

In a former period of my life, I occupied, under a grandfather, a farm of nine hundred acres of land, with as great diversity of soil as is, I believe, to be found in the same compass, in any part of the kingdom. During this occupation, I made many experiments of renovating old pasture land by tillage, and afterwards returning it to its original state. Amidst a variety of these essays, the following appeared to me the most worthy of imitation: I recollect breaking up two pieces of old pasture land, of an exact similitude of soil and aspect. The first piece I ploughed with a common Norfolk plough in the beginning of March, with furrows of about four inches depth. I then harrowed in, broad-cast, four bushels of oats per acre, rolling the land with a very heavy roller, as soon as the soil was sufficiently dry to permit the operation. The crop proved abundant; nine quarters per acre came to the bushel, exclusive of a very great loss which was scattered in the field: the oats were shorn, leaving the stubble about eighteen inches high. The first fine day after the oats were carried off, I took the advantage of a fair wind, and by the help of a candle and lantern, I so completely set fire to the standing stubble, as to consume every particle of it that appeared upon the surface; but previously to my so doing, I used the precaution of mowing the verges of it to prevent any injury being sustained by the surrounding hedges. This operation completely destroyed every weed and seed that grew, leaving the surface entirely covered with ashes. As soon as harvest was finished, I ploughed the land of a depth just sufficiently to conceal the ashes, and about a fortnight afterwards, I ploughed it again two inches deeper than before. By this variation in ploughing, the ashes became completely intermixed amongst that portion of the soil designed for vegetation. In the month of November I sowed it, broad-cast, with three bushels of wheat per acre, which I ploughed in furrows of about four to a yard, and at a pitch rather less than that at which it was at first broken up. This crop, like the last, proved extremely

advantageous; its produce being full five quarters per acre: I now once more recurred to my fiery system, which was accomplished as before recited. Although it was my intention to have laid the land down with the second crop, I was induced, from the redundancy of its produce, to run the hazard of a third. I again sowed it with oats in the latter end of February, which I ploughed in, broad-cast, and which were reaped in the middle of July. After the oats were removed from the land, I mowed the stubble as close as it was practicable so to do, which I had directly collected, and carried into the straw-yard. Before July was expired, I ploughed the land the usual depth, harrowing it slightly, but sufficiently to fill up the principal cavities upon the surface. When this was achieved, I sowed my grass-seeds, harrowing the soil till it was sufficiently pulverised for their vegetation and security; I then rolled it down, and left it to its fate. The last crop of oats had not a weed in it. The seeds in about a fortnight sprouted with great promise, and the oats that were shed upon the land grew up and proved a most excellent nursery for them during a winter of more than usual severity. I should also have burnt my stubble in the last crop, but as it would have destroyed the oats that were shed, I omitted it that they might answer the purpose I have just related. In the spring of the year my seeds had a most favourable aspect, when I again applied to them a very heavy roller, and in the latter end of May I stocked the land slightly with both sheep and bullocks. After the first season, the land was mown and fed in the way it had been formerly occupied, and so far was it from being injured by tillage, that the crops of both grass and hay, as long as it continued under my observation, proved infinitely finer and more abundant than any of its former produce. The grass-seeds with which the land was sown, were the shaking of the finest natural hay I could procure: three bushels of which, with the intermixture of three pounds of narrow-leafed plantain, and ten pounds of white clover-seed were sown per acre. The hay which I selected for this purpose, stood rather longer before it was cut than is the usual practice: by this method, the seeds became properly matured for vegetation, and the hay itself sustained little or no injury, either from so doing, or from the shaking out of the seeds, which was performed with a common fork: the soil that I have been speaking of was a loam, approaching to a clay. The other piece of land, which was only parted from the foregoing by a fence, I sowed with the same succession of crops as I have previously stated, but with very different cultivation and success. When the first crop of oats was housed, the stubble was rolled down

with a heavy roller, and ploughed in to rot, as is the common practicein this county. My wheat crop which succeeded, fell short eight bushels per acre of my first, and had an infinity of weeds, from which that crop was totally exempt. Here again, instead of burning, I ploughed in my stubble, and in the ensuing spring, to keep up the exact similitude in cropping, I sowed this land with oats; harrowing in immediately after them the same compound mixture of grass-seeds as I before described. Here, as in my preceding crop, I found a considerable deficiency in my produce, and I had the additional mortification of seeing my crop of weeds increase in the same *ratio* as my crop of corn diminished. But this proved not my only disappointment; the combination of weeds and straw so totally extinguished every vestige of my grass-seeds, that I was compelled to re-sow the land as I had successfully effected in my first experiment. These seeds promised in the spring extremely well, and the land was stocked and fed exactly as the piece I first described. But in the succeeding seasons, the disadvantage of my second process was proved to demonstration: the crops of hay and grass were coarse and full of weeds, and so continued to the period at which I resigned it.

From the foregoing experiments, it is evident, that the burning of the stubble, and sowing the seeds at the time I practised it, are infinitely preferable, in every view, to any of the usages in either the old or the modern school. Where the soil is less luxuriant, I would recommend taking but two succeeding crops, and either laying the land down immediately after the second, or sowing a crop of turnips; and then, after a crop of either oats or barley, returning it to pasturage. Should the land be still of a slighter texture, I would take only two crops in the whole, and those with the intervention of a crop of turnips, laying the land down after the last as before described. When the land is so light as to give no expectations of a redundant produce, the seeds may safely be sown at the accustomed season, but where the corn is likely to smother them in their infant state, August is indisputably the better time.

Independent of my own experimental information, I have not been an inattentive observer of the practice of my neighbours. I have seen a variety of soils turned from pasturage to tillage, and *vice versâ;* but I never saw any mode succeed equal to that of my own adoption. In all the experiments of others, the operation of burning has invariably been omitted: a measure equally calculated to enrich the soil, and for the extirpation of the weeds. I once, in order to bring a piece of

land into the same course with others that surrounded it, sowed it with oats, though conscious it was extremely foul. Here carlocks, wild-poppy, and a long *etcætera* of obnoxious plants portending me more injury than profit, I ploughed up one half of it before the seeds were ripe for propagation, and the other half I permitted to stand till they were sufficiently combustible for my fiery operation. I then took my candle and lantern, and consumed them as I had done the stubble. The consequences strongly marked the advantages of my second trial. The whole piece was in the ensuing season sown with turnips, when that part that had been burnt proved infinitely cleaner, and more productive than that which had been ploughed.

No. LVIII.

Burning Straw.—*By Mr. William Pontey, of Huddersfield.*

The following instance of the effect of heat upon fallows, may furnish matter for useful reflection. A neighbour of mine has a mill, where he shells a considerable quantity of oats, the husks of which he was used to burn, and to spread the ashes upon his grass-lands; but their effects were only observable for one season, and were by no means considerable. Within the last ten years he has fallen into the practice of spreading the said husks upon his fallow when it is dry, to the depth of six or eight inches. To these he sets fire as soon as the wind is favourable, and though the quantity of ashes left be very trifling, the article being very light, yet the soil is uniformly so enriched, that, though no other tillage be applied, the burnt part is distinguishable, from what was tilled with either lime or dung. To these effects, I have for several years been an attentive observer of the benefit for four following crops.

No. LIX.

Long Dung.*

Whenever my land will bear the carts, I carry on manure, be it what season of the year it may; it not only saves me the expense and trouble of putting it to heap for a future dressing, but renders me its immediate aid. On meadow land in summer time, though the grass is thereby at first of bad flavour, yet hungry cattle will eat it. In my opinion, stable dung never answers a better purpose than by carrying it on the land as soon as made. I laid it over a piece of wheat in frosty weather, and at harvest it was all laid to the ground. On grass land in the spring it screens it from cold winds, and occasions it to be more forward; and in the midst of summer the strawy part screens the land from the over heat of the sun; in either season it will soon be grown in and nearly lost to the eye.

No. LX.

Oil and Soda, &c.—*By Mr. Thomas Baldock, of Burwash, Sussex.*

I have tried oils mixed with soda, pot-ash, and lime, and incorporated with light, sandy, and dry earths, and sowed as a top dressing in the spring; but not having sufficiently experienced this manure, as to quantity, expence, and profit, I shall forbear mentioning it further, than just to say, that it has always produced a visible good, the few times that I have tried it.

* The essay from which this extract is taken, was without a mark, or corresponding paper.

No. LXI.

DUNG; EXHALATION.—*By Mr. John Martin, of Naseby, Northamptonshire.*

IT is not so necessary, in my opinion, to plough in long dung immediately after spreading, as is generally imagined, for fear of losing the strength. It will indeed dry and appear strawy, but the watery particles only are exhaled, not the saline, which latter will not evaporate. My opinion is founded upon an experiment made last summer, which was as follows: I dissolved half an ounce of nitre, nicely weighed, in six times its weight of spring water (it will not dissolve in less), in a shallow, glazed earthen vessel, which was placed in a situation where the sun's rays prevailed much, in the hot days of July. In three days the water was all exhaled, the nitre crystallized into spar, and of the same weight exactly, as before it was dissolved.

No. LXII.

COMPOST.—*By the Rev. Robert Duncan, near Kilmarnock.*

I HAVE often seen, but never would commend, the forming a compost of lime and dung; I may notice that it is my decided opinion, that when lime and dung are laid on land for the same crop, the dung should be ploughed down, and lime harrowed in with the seed-furrow; in fact, it is an unspeakable loss to the farmer to use dung in any other way.

No. LXIII.

Soot.—By *Mr. John Kiddle, of Marsham, near Aylesham.*

All manures that are laid on the surface of land, cannot be laid on too early in the season. Soot, for instance, is always recommended to be sown on wheats or clovers, and grass lands, in the month of February, from a notion, that if sown sooner, they would exhaust themselves too soon. This I think absurd reasoning. No manure can be of any service to the crop which it is meant to advantage until it reaches the roots; and what contributes more to save it than the winter rains, and the dissolving of the snow. I have, in consequence, always sown the soot for wheat and clover, when I have been able to procure it, in the month of November or December, and always with satisfaction to myself. I last year sowed with soot, an inclosure of wheat of eight acres, part of which was sown in the beginning of December before the frost set in, and a heavy rain succeeded the sowing; on the remaining parts, owing to my not being able to procure more soot at that time, the sowing was postponed until after the frost was gone, in the month of February. The quantity sown on an acre, in both instances, was equal; but the superiority of the crop of wheat, where it was sown early, might be discerned by the eye. I had the curiosity to have it thrashed separately, and found its increase beyond the other considerable. If I could procure soot at the time of sowing wheat, I should be under no apprension of its answering then, if the land was worked for the wheat. Some years since, having bought a small quantity of soot immediately after harvest, I had the desire to try its effects on the crop at that early season, and having a pea-stubble which had been ploughed twice, and was designed for wheat, after sowing as much of the land as I had soot for with wheat, I then had the soot sown, and ploughed both in together. I own I was anxious to see the success of my experiment, as it was a novel one, as were my neighbours, who had seen it done. The remainder of the land was sowed with soot, as I was able to procure it. The wheat, where the soot was sown with it, kept the lead during the first months; this I did not wonder at, but expected it from its forcing quality: but I was very much pleased to see it continue to do so during the remainder of the season, and at harvest the superiority in favour of it was easily to be seen.

No. LXIV.

Time of manuring new Lays.—*By the Rev. N. Cotton, of Thornby, near Welford.*

I should reserve all the straw converted into manure to be used on the grass-seeds, or rather at the time when the clovers are wearing off, before the natural grasses are established. At that time, there is generally an unprofitable season, which may last more than a year, and then the diligent and attentive husbandman should top dress, particularly the weakest parts of his field, the dunghill being mixed judiciously with lime and soil. This practice would admit of covering with a bush harrow, a quantity of the best grass or hay-seeds that can be obtained.

No. LXV.

Quantity of Manure for new Lays.—*By Mr. Morris Birkbeck, of Warnborough, near Guildford.*

Turf may be restored to its former fertility; and, for this purpose, it is only necessary to observe one simple rule; *viz.* let manure, equal to the whole exhaustion incurred during the course of tillage, be replaced on the grass. To ascertain this, an accurate account should be kept of the straw and grain produced by each crop. The same weight of grain and oil cake consumed by horses, cattle, or hogs, littered on an equal quantity of straw, will furnish an equivalent in manure sufficiently exact for our purpose.

Had due attention been paid to this circumstance, the plough needed not to have been so scrupulously excluded from our old pastures. In fact, this is the essential point.

No. LXVI.

The Time of Manuring.—*By William Payne, Esq. of Frickley, near Doncaster.*

It will by no means be unseasonable here, to offer a few remarks on the proper season for laying on manure, for it is perhaps yet but little understood, or considered, that manure of most kinds, and in most situations, if laid on during the winter, is nearly thrown away. This is a great and crying abuse amongst many attentive farmers; they take advantage of a fine hard frost and snow, cart their manure on thin green swards, &c. clean, and without damage to the lands. But they are not aware, that during the winter season, when vegetation is inactive, when the surface of the soil is locked up; the effects of frost, thaw, snow, and rain, are to destroy, to dissipate, and wash away the fertilizing powers of manures; and the dissappointed farmer, if he has not the sagacity to discover the cause of his want of success, frequently attributes the failure to some other than the real cause; and perhaps is tempted by the next frosty winter to repeat his blunder. The "good old time" for this work continues to be the most profitable time, which is immediately after the hay time, from about the middle of July to the end of August, at which season vegetation is still in its vigour. If that season escape or be inconvenient, the manuring ought to be deferred till the spring, from the latter end of February to that of March, when vegetation usually commences; but in this case the manure must be fine and minutely spread; then, after the first rains that fall, the plants will imbibe the fertilizing qualities of the manures, and will grow with their growth, and strengthen with their strength.

V.

FALLOWING.

No. LXVII.

On Summer Fallowing.*

Winter fallowing and summer fallowing are just as opposite in their effects, as winter and summer are different. The former does infinite service in causing the different particles of earth to unite; the latter does a great deal of harm, in constantly exposing fresh surfaces to the searching property of the sun. Winter and summer to land, I consider just the same as day and night to man. The day is the time to labour, and the night to rest. The winter is the time for the earth to lie in a torpid state, and surely in the summer it ought to produce something. Summer fallowing by farmers is called resting; but, as I conceive, very absurdly. My ideas are, that one summer fallow will exhaust land more than ten crops. Every thing in a living state receives comfort and support from the sun, but in a dead state the effect is directly opposite: meat will soon become putrid; timber will begin to decay. By summer fallowing, a numerous reptile tribe is destroyed, and thereby the vegetation has no living creature to subsist on it. This may account for the idea of its improving the quality of the land; but were this the case, the oftener recourse was had thereto, the more improved land would be; but if such lands as have been summer fallowed the most frequently are not found the poorest, then I will drop the subject. To lose a year's rent and labour only to do harm, is certainly a bad system. If land wears out, as it is termed, by cropping, it reasonably follows, that such land as produces most, must wear out the soonest. This however is not the case, since meadows, coppices, and hedge-rows, produce crops year after

* No letter with this Essay.

year for ever. If summer fallowing can be considered as supplying the earth with vegetable matter in any possible kind of way, then one may naturally conclude, that such kind of land as I have just mentioned, must be the soonest exhausted, because it is always deprived of the benefit so arising. Two opposites cannot agree. I have heard much reasoning about a good crop of clover, or a good crop of pease, being necessary towards attaining a good crop of wheat, and a good summer fallow is also said to be equally necessary. One through a prodigious vegetation covers the land through the summer from the sun; the other produces nothing, and exposes the land to the sun in every manner possible. When a ploughboy myself, I recollect breaking up a large rye-grass ley field, and half of another, after the lambs had been fatted and gone; it was land of a prime quality, on a bottom, between sand and brick-earth. At the time of wheat sowing, it was not possible for land to work better or more mellowly; and not a root of any sort was to be seen in a quick state on the fallow. The field, which was only half of it fallowed, gave proof quite sufficient of my position. That part which was sown out of ley produced a fair crop, but the fallowed part did not produce straw so tall by several inches. The ears were smaller and much thinner whilst standing on the ground; the difference I should suppose to be about one-third against the fallow, which was nearly choaked with the poppy or red-weed, whilst the ley ground remained free from it.

No. LXVIII.

Atmospheric Influences.—*By the Rev. Dr. Graham, of Aberfoil, near Stirling.*

It seems indisputable, from many decisive facts and experiments, that nature has provided stores for ameliorating the soil, and for rendering it fit to produce abundant crops, independently of those which are furnished by human industry. Of these, the chief that we shall mention are the neutral salts, which are well known to be highly efficacious in promoting vegetation; and which, as we have cause to

believe, are produced every day, by natural processes, and added slowly, but regularly, to the soil.

I. We have an instance of this in the production of salt-petre, by the combination of the nitrous acid with an alkaline base. The alkaline base is furnished spontaneously by most soils; the nitrous acid floats about abundantly in the atmosphere. (See Dr. Home's Principles of Vegetation, page 142), seeking a subject with which it may unite. Accordingly no other process is required in Spain, for forming salt-petre, than to expose the collected filth of the streets, for a certain time, to the air, from which it imbibes the nitrous acid: the mass is then thrown into preforated vessels; water is poured on, and filtered through them, which, when evaporated, yields the crystals of nitre. The same matter being again exposed, for a certain time, to the air, becomes again impregnated with nitre; and may thus be subjected, from time to time, to the same process, without end (See Townshend's Travels in Spain).

II. The carbonic acid, which the ingenious Dr. Kirwan has shewn to constitute the principal part of the food of plants, resides also, in a copious measure, in the atmosphere, ready to combine with calcareous earth, its proper base. This is evident, from the well known circumstance, that lime-stone when calcined (i. e. deprived of its carbonic acid), gradually recovers its acid, and at length becomes completely saturated with it, in about the space of a year, by being again exposed to the influence of the atmosphere. Indeed, it might be demonstrated, were this the proper place for it, that lime does not produce its complete effect in ameliorating the soil, till it has thus recovered its acid.

III. Again, it has occurred from a hint suggested, and merely suggested, by M. Berthollet, in an essay on bleaching, published in the *Annales de Chymie*, that there is cause to believe, that nature hath furnished another copious source of saline substances, adapted to the amelioration of the soil, in the rays of light.

M. Berthollet remarks, "that there seems to be a striking analogy between the solar rays, and oxygenated muriatic acid, now used in bleaching, in their nature and effects." It is observed, accordingly, that the effect produced by the rays of the sun upon the coloured parts of bodies, is altogether similar to those produced by that acid. The former more slowly, and the latter more rapidly, destroys the colour of cloths, and performs the operation of bleaching. Bleaching was formerly performed by the application of an alkaline ley, joined to exposure, for a long

period, to the solar rays; but, in consequence of the late discovery, the same operation is performed in a short time, by the oxygenated muriatic acid, with the addition of an alkaline ley.

In both cases, the operation appears to proceed on the same principles. In both cases, an alkaline base is necessary; and in both cases the presence of an acid is requisite, in order to form a neutral salt: in the one case, this acid is furnished slowly by the rays of light; in the other, it is applied at once in a more concentrated form.

Not to speak, then, of the well known influences of light, in perfecting the productions of vegetable nature, it would seem that the rays of the sun, by combining with the alkaline particles of the soil itself, contribute to its fertilization. There seems, therefore to be reason to conclude, that all-bountiful Nature hath furnished, without the co-operation of man, very liberal stores for the improvement of the soil: it is true, these are too scanty to supply the great exhaustion of vegetable particles which takes place in lands under regular tillage; here, applications furnished by human industry, must come into the aid of nature. But it may be concluded that lands which have, for time immemorial, been in grass, are sufficiently enriched by the natural processes which have been enumerated, especially if we add to these the urine of the cattle which have been pastured on them, to fit them for producing at least a single rotation of highly beneficial crops.

Experience seems to confirm these deductions of theory. The Author of this essay has repeatedly had occasion to observe, under his own eye, that virgin earth, or a soil which had never before been turned up by the hand of man, produces, for a few years, far more abundant crops than land, however rich, which has been exhausted by frequent cropping.

He now possesses a small field, of about a Scotch acre, which, about twenty-five years ago, was brought for the first time time into cultivation by his predecessor. It is a rich, quick, sandy soil. The field was full of large insultated stones, which were blown up with gunpowder, and are now employed in inclosing two-thirds of the circumference. The returns in oats, for the first two years, are talked of in the neighbourhood as uncommonly great; and the Author has been able authentically to ascertain that when it was, for the first time in the rotation, laid down in barley, it produced a chaldron, or sixteen Scots bolls, though it is usually sown with three-fourths of a boll of barley. This field is now under the usual course of cropping,

and has become precisely of the same character and quality with the adjacent grounds.

Even in lands which had been over-run and choked with thorns, broom, and furze, the Author has had frequent occasion to observe, in them, when cleared, an uncommon fertility, which amply repaid the expences of cultivation. It would seem that the acids which float in the atmosphere, are arrested and confined by the leaves and branches of the shrubs which overspread the ground; so that instead of being dissipated, as they are in more exposed situations, they are added to the subjacent soil, and occasion its superior fertility.

There is even reason to believe, that the wonderful fertility of the soil of North America is to be accounted for on similar principles.

That country is covered with forests. A wide-spreading tree probably robs the ground of much more vegetable matter than it restores to it by the shedding of its leaves; still, however, when the woods of America are cleared away, the soil is inconceivably fertile. Is not this fertility to be principally ascribed to the stagnation of the atmosphere, occasioned, for so many ages, by the closeness of the woods? The airs formed by the natural processes of fermentation and putrefaction having no opportunity of escaping, have not been lost in the common mass of the atmosphere, but have incorporated themselves gradually with the soil, and formed a copious store of those substances which are most conducive to vegetation.

It seems therefore to be a fair deduction both from theory and experience, that lands which have never been subjected to the operations of agriculture, or which have even been exempted for a long series of years, possess uncommon fertility, and extrordinary powers of production.

VI.

OPERATIONS OF TILLAGE.

No. LXIX.

DEEP PLOUGHING.—*By Mr. Thomas Baldock, of Burwash, Sussex.*

IT is thirty years or more since I purchased a farm of about seventy acres; sixty plain, the rest coppice, pretty kind for oak, ash timber, and underwood; the soil almost all on a marl bottom, with a very little gravel. It was very poor indeed when it first came into my hands, and I could trace it back to have been most wretchedly used for fifty years at least, by the different occupiers, with some of whom I was acquainted. The fences were sadly ruined, and coppices very much eaten up and spoiled. There were pretty many young oaks, and some ashes, but none of timber size, and those confined to the copses. My living in the pleasant village of Burwash, at about a mile distant from this farm, enabled me to procure some town dung, with ashes and soot, and some rich soil, from my own and other reservoirs and vaults and soil-holes in the town. This in a few years gave me a pretty good spring of grass, and enabled me to grow a little corn, some green food for cattle, and potatoes. In six or eight years I fattened some beasts and a few sheep, and also kept two cows, and did my work with two oxen and two horses. What fresh mould I could pick up was mixed and cast together; this much increased my manure, and these increased my grass and corn, and these again my dung, &c. Now, finding my land very subject to be too wet, and to hold the water from its tenacious and clayey super-stratum, I set about under-ground and super-draining, and making deep ditches along the sides of the fences, and thus in some degree laid it more dry, and by these various means improved it certainly

at least to treble its value when first taken, in both corn and grass and general product. Not quite twenty years since I purchased another farm, much larger, lying near a mile from Burwash, in the direct road to May-field. This lay upon a very agreeable elevation, with an old private road running along the elevated part, the land falling gently nearly the one half to the north-west, and the other half south by east, with small streams for their boundaries. This farm, from the old lane to thirty or forty or more roods, had a substratum of gravel, though with much clay amongst it; and might be called a stiffish hazel loam: below this was a marly soil, with a clayey top. It was therefore very subject to hold the wet. I went on improving this, as I had done the other, till this time, by trunking, ditching, and manuring with what I could get, of every sort I could procure of dung and fresh mould, and marl on the gravel, soot, wood, ashes, cleanings of ponds and ditches, and every kind of fresh thing that I thought might in any degree be serviceable to the land. On this and the other farm I had some hop grounds; I cultivated corn and some pulse, besides potatoes; some cabbage and turnips, tares and seeds, &c. After some years experience on both farms, I found the wet hanging too much and too long on the greater part of my land, especially the wheat ground and hops, and often getting too late, and too wet with my wheat season, as I found my neighbours in general did, by which we suffered much in having poor, thin, and sometimes wretched crops of wheat, and the wet-hanging hop grounds turning to very poor account. I considered the wet-hanging through the winter, and often late in the spring, as my greatest enemy. This my neighbours could see as well as myself, and yet we were apt to get too late with our wheat season, and therefore sinned with our eyes open, and to the injury of ourselves and the public. These considerations made strong impressions on my mind, and made me determine to get the better, as much as I was able, of the dampness of the greatest part of my plough land and hop grounds. I usually fallow for every crop of wheat, and manure with lime and marle, and sometimes compost. Our course of cropping is almost uniformly, fallows and manures for wheat, next oats with seeds, chiefly ray-grass and red clover, but sometimes a little trefoil and cow-grass. There is very little barley or turnips, and less of cabbage and tares in our district (my land excepted). To get the better of wetness of soil, I found it best to get as complete fallows as possible for wheat, and for that end to plough up before Christmas of a good depth, with a twelve-inch furrow, and turned flattish; I then stirred the ground in March,

or the beginning of April, by turning the furrows back again, and forward and backward three or four times more during summer, but never did this work when the ground was too wet and soft. For my land, I find this tillage effectual to kill weeds, and that the land has the best effect from the sun and air. About Midsummer, or the beginning of July, I plough the fallow into four whent ridges (as called with us), or eight furrow lands, and made flattish, and then go with the plough another turn, to deepen the furrows between the ridges. Sometimes on the wettest land, I go with the plough twice, and deepen the furrows to twelve or fourteen inches below the surface of the lands. This being done whilst the ground is dry, which is mostly the case, sometime about the turn of the days, and often much later, prevents the soil holding the water too much: even through autumn and winter, it easily finds its way into the furrows thus deepened; and by water-furrows still deeper, it is effectually carried off the land. These may be stirred once or twice more before the wheat is sown, still having the furrows equally deep as before, and the ground will then be ready for sowing the wheat at what time it is thought best, which on these cold heavy lands should be towards the latter end of September, unless the weather be too dry. With this management, and proper manure, there will almost always be saving crops, and sometimes very large crops of wheat; the Lent corn and seeds will be much better, and the land get in better order; and by continuing this practice, the land will get better, and the influence of the sun and atmosphere will greatly improve it. Keep the cold stagnant water from hanging in the soil, and keep it open to the sun and air as much as possible, and the land will be greatly ameliorated in a few years. This I speak from most certain experience; for since I have kept steadily in this practice, I can safely say that my wheat crops have been fully doubled, and the grain is in all respects fuller, heavier, and better. The furrows should be opened after the oat crops are off, for the benefit of the clover crops; it preserves them from the wet in winter and frost, and makes them much stronger and better, as well as earlier in the spring, and summer.

No. LXX.

Deep Ploughing of Grass Land.—*By John M'Murdo, Esq. of Milne Head, Dumfries.*

We have witnessed instances where old pasture lands, composed of a gravelly loam, were broken up in the spring for barley, by trench ploughing. The old sward was turned into the bottom of the furrow, and a dry subsoil brought to the surface from a considerable depth. The crops failed entirely, and there appeared two very obvious reasons for this failure; first, the subsoil brought to the surface to form the seed-bed, had been long deprived of the ordinary influence of the atmosphere, and the rains, consequently must have been for the time cold, and infertile. Secondly, the dry tenacious sward having been placed half broken under the seed-bed, the natural moisture of the ground, as well as that which fell in rain, was speedily and habitually evaporated: unless in a season of uncommon moisture, a crop under such preparation could not prosper.

No. XLI.

Trench Ploughing Grass Land.—*By Mr. George Pung, of Ballingdon Hall, near Sudbury.*

Double furrowing is not intended to plough the land any deeper than usual, but it separates the turf from the lower part, and the second furrow not having any of the roots of the grass to hold it together, the corn is covered better, and has I think every chance of producing a greater crop.

No LXXI.

Rolling.—*By Mr. Christopher Morley, of Newark.*

As draining is the first, manuring the second, and cultivation in the third, I consider rolling as the fourth principal object in agriculture.

Old sward land or grass-seeds, upon first breaking up, should always be rolled before dibbling for either wheat, beans, or pease, as it makes the land more solid, and the grain, when it vegetates, will form a stronger root. Wheat should always be rolled in the spring after frosts, as it will make the soil adhere more closely to the roots of the plants, which very much encourages vegetation, and will cause the stems to be much stronger, and the grain will be brought to greater perfection. Barley and oats should always be rolled when the blade is about an inch above ground, if the weather permits; and turnips should be rolled at nights soon after the plants make their appearance, which will be a means of destroying a great number of slugs and snails, that are very destructive to the young plants.

Sward and meadow land, should always be rolled in April or the beginning of May, and when the ground is in a moist state, as it will destroy a great many ants, cause the grass to be of a more kind nature, and will make the surface of meadows more smooth for mowing.

There are various sorts of rollers made use of; those that I have found to answer the best, and consider as being upon the best construction, were made of cast iron, and divided into two parts: the length from three feet to three feet six inches each, covering a surface from six to seven feet and being above ten hundred weight; the frame to be made stout, with shafts for one horse to be fixed on the near side, and hooks fixed on the other side, to add an additional horse when necessary. The gudgeons or pivots should act upon small case-hardened friction-wheels, two to be fixed on each side the frame, with a small roller made of hard wood about nine inches long and three inches diameter, bound at each end

with iron, and to be fixed to the back part of the frame, so that both rollers may act with each other in the centre, which will be a means of keeping the great roller steady, and very much diminish the draught.

No. LXXII.

A new Ploughshare.—*By Mr. John Mossop, of Deeping, Lincolnshire.*

If the soil is too stiff to receive the seed cordially, fix an instrument upon the middle of the top of the ploughshare, like a short knife-blade, to cut the furrow in the middle, so as to leave it like two furrows instead of one. This will favour the seed's reception, and be found useful to the farmer.

VII.

COURSES OF CROPS.

No. LXXIII.

CLAY.—*By John Wilson, Esq. Park Hall, Balborough, near Chesterfield.*

I MADE an experiment on strong clay land; it belonged to a gentleman at some distance from me. I persuaded him to take up part of the field, to employ two or three carts, and dig up the ant-hills, and carry them on to large heaps in proper places in the field, and when I went over again, I was surprised to see what heaps of earth those hills had made. I then persuaded him to get some lime to mix with this heap of earth, and to pare and burn, and sow it with wheat. The spring after the wheat was reaped, it was sown with oats; the winter after that, it was made a kind of winter fallow, that is, it was ploughed, and harrowed in the winter, which is a silly practice, for this sort of fallowing never kills any trash in the land. It was sown again in the spring, all but half an acre, which I desired might be left unsown. I caused the half acre to be ploughed again in the summer, and sown the first week in July with seeds only. In the piece that was sown with corn and seeds, the seeds were thick enough, but very weak; in the half acre that was sown with grass-seeds only, they were as strong and powerful compared to the others, as if they had been sown a year before them. The summer after, the land on which the seeds were planted astonished the gentleman, and all that saw it, for they were positive I could not raise any grass-seeds in this way; the half acre, however, beat the other much. The quantity of soil that was made from the ant-hills, and the lime that was mixed with them to be laid upon the seeds afterwards, nourished the seeds, and made such improvement, that the piece of grass ground,

looked to the sight of any man to be worth treble the value of the adjoining land.

On old clay field lands that have been in tillage a long time, it is more difficult to make grass-seeds grow than on fresh lands of the same sort. I have seen a large clay field laid down with seeds, which were sown along with the corn; the corn sucked all the virtue out of the ground, and then the seeds perished; but these old clay fields should have a good summer fallow, and instead of laying them down in the spring with corn and seeds, they should be laid down the first week in July, with grass-seeds only, *viz.* about three quarters of good hay-seeds, about three pecks of rye-grass mixed with the hay-seeds; then 8lbs. of white clover, 8lbs. of trefoil, 4lbs. of red clover, to one acre, and so in proportion to each acre. If on clay land gentlemen will but pursue this plan, they need not fear raising good grass.

No. LXXIV.

Clay, and Stiff Loam.—*By William Salkeld, Esq. of Fifehead Nevil, near Blandford.*

1. Beans.
2. Wheat.
3. Beans in drills, with intervals of ten inches in double rows at four inches, and hoed.
4. Wheat.

This course is successfully practised in my neighbourhood; it may be continued many years.

No. LXXV.

Loam on Clay.—*By Mr. Thomas Cussans, of Bedhampton Park, near Portsmouth.*

I LAID down about forty acres of land into pasture without corn. I made the land very clean by Midsummer, and sowed it with seeds, 6lbs. of Dutch clover-seed, 2lbs. of rib-grass or lamb's tongue, 2lbs. of rape-seed, and one bushel of ray-grass. I laid the land level, except a few furrows to take off the dead water, and trod it with sheep in six weeks after it was sown; the sheep thrived well; the feed of the rape dressed the seeds, and brought it to a sward remarkably soon. The rape stood the winter, and produced a great deal of food in the spring following. I have dressed it and fed it with sheep continually, except two acres, which I took out of the said field to make an orchard, which I was obliged to mow to preserve the young trees; and that appears as though it would never make good pasture, owing to its being mowed. I fed the same kind of land: it appears to be better than old pasture adjoining, which has been laid down time out of mind, and the sheep are so much fonder of the new pasture laid down without corn, that they are not satisfied elsewhere. The soil is hazel mould, on a bed of clay and stiff clay, and black mould of the peat kind, and wet and dry sand; all this makes good pasture, owing to its being laid down without corn as before mentioned. I have laid down into pasture twenty acres of ground, that was rough pasture, almost covered with furze and broom; it was grubbed, and remained in tillage seven years. I made a good fallow and sowed is with seeds, 6lbs. of Dutch clover, 3lbs. of rib-grass or lamb's tongue, one bushel of clean ray-grass. I laid it down three years ago last June, have continually fed it with sheep, and it is become good pasture. I know a butcher who has laid a field into pasture; the soil good thick-fold land. Half the field he laid down without corn, the other half with corn; he told me, that where he sowed seed without corn it answered well, and that the other part was but indifferent.

No. LXXVI.

HEATH.—*By Mr. William Curtis, of Lynn, Norfolk.*

IN a very considerable farm which I occupied, I had a piece of land adjoining to another of a similar soil and situation, belonging to a neighbour. It was old heath that had never been ploughed, and was of a lightish and moderate quality. My land was sown with oats upon the flag, and in the ensuing winter had a coat of marl of sixty loads per acre. It was then sown with turnips, and laid down with red clover, trefoil, and rye-grass, agreeably to the practice upon the neighbouring lands. In this state it remained two years, and was afterwards subjected to the same rotation of cropping, &c. as the rest of the farm. During the continuance of my lease, this land had invariably the advantage in produce of all the rest in my occupation. The land belonging to my neighbour was fresh sown with oats, then with wheat, and then once more with oats; after which it was marled, exactly as I have described my own. The result was, that the two oat crops produced about six quarters each per acre, and the wheat about three, but they appeared to have nearly annihilated the fertility of the soil. It was seven years under my observation, and I never saw one crop afterwards that paid the expence of seed and culture. From hence it may be inferred, that land of a slight texture cannot be too sparingly cropped on its being first transferred from grass to tillage.

No. LXXVII.

LIGHT STONEY MOORLAND.—*By Mr. Charles Ritchie, of Culmore, by Stramaur.*

POTATOES and wheat alternately, in some situations, may prove beneficial. I shall state the produce of a field, consisting of six acres, which has been, and is continued under that husbandry for these three years past, *viz.* soil, light-stoney-muirland.

On six acres of ground, summer fallowed in 1796, and limed with a little compost made of sea-weed, and knot and couch-grass gathered off a large adjacent field,

		£.	s.
Crop 1797.	Oats (having rather too little dung to risk wheat), 432 bushels, at 2*s.* 6*d.* - - - - -	54	0
Crop 1798.	Potatoes lightly dunged, 1440 bushels, at 1*s.* - -	72	0
Crop 1799.	Wheat, 180 bushels, 12*s.* - - - - -	108	0
Crop 1800.	Potatoes lightly dunged, 1150 bushels, 2*s.* 6*d.* - -	143	15
	Total amount of the produce of six acres for four years	377	15
Crop 1801.	Sown with wheat again, and looking well.		

Now, my Lord, should the author be spared for these three years to come, he shall then give your Lordship the whole produce of this field for seven years, with a full state of expences attending it; and wherein the profits (if any) will be ascertained.

No. LXXVIII.

Clover.—*By John M'Murdo, Esq. of Milne Head, Dumfries.*

Clovers invariably fail, when sown upon lands that have been recently converted to tillage from old pasture, provided any part of the roots or old sward remains in the soil, whether these be quick or dead.

No. LXXIX.

General Remarks.—*By Allen Grebel, Esq. of Canterbury.*

There are so many eligible systems to be pointed out, that no one can be exclusively recommended. The occupiers should observe, however, that no two corn crops should succeed each other on any account—that turnips, if possible, should be the first crop, to be folded off; also the tares, which should be dunged for, if convenient, and after the first breaking up, succeeded by turnips in the same year, also folded. If potatoes come in the course, to let them be succeeded by barley, or oats. The clover crop which may be coal-ashed, or gypsumed (if gypsum suits the soil), always succeeded by wheat: the bean crops may also be succeeded by wheat, or may at the last shimming be sown with turnips, which will produce a good deal of feed, and make an excellent barley tilth. What manure you can procure is always to be given to the ameliorating crops, and not to the corn ones.

VIII.

CULTURE OF THE CROPS INTRODUCED ON BREAKING UP GRASS LAND.

I. WHEAT.

No. LXXX.

DRILL HUSBANDRY.—*By Dr. Fothergill, of Bath.*

OF our modern improvements, the introduction of the drill husbandry has been generally allowed to be the most important. Its great utility in saving of seed, in sowing it at an equal depth, and in keeping the land clean by the intervention of hoeing, has been proved by a variety of experiments, and particularly of late by Mr. Coke, of Holkham, in Norfolk, who from thirteen years experience on a farm of 3000 acres, has found this mode of husbandry far superior to the broad-cast. By drilling six rows at a time, nine inches apart, he sows an acre in an hour with a single horse, allowing only seven pecks of seed, which is scarcely half the quantity usually sown in broad cast. He not only saves a bushel and a half of wheat per acre, but also obtains twelve bushels more in the annual crop! Such a diminution in the consumption of seed, though only estimated at 6*s.* per bushel, would, on so large a scale, certainly amount to a very considerable sum! This method is thought by some to be equal if not preferable to that of dibbling. A new mode of dibbling in clusters, at a few inches apart, has been lately recommended by the Reverend Dr. Trusler, as superior to every other method. Being now under trial, its merits will probably, at the ensuing harvest, be brought to the test.

SORT.

ON being elected an honorary member of the Massachusetts Society for promoting Agriculture, the treasurer favoured me with the following article of intelligence

inserted in their Transactions, which relates to the subject in question, and appears to be very interesting.

" Mr. Isbell, of Caroline, in Virginia, a few years ago purchased of a merchant a quantity of mixed wheat, and having sown it, accidentally observed, when the rest of his wheat was in flower, a single ear almost ripe: hence he conceived it might be a different species. To determine, he carefully preserved the wheat produced by his solitary ear, which had multiplied to such a degree, as that several thousand bushels were obtained at the subsequent harvest, for it had been distributed into many hands.

" From several trials on different soils in the two succeeding years, it appears that this wheat is ripe from fifteen to twenty days before any other. The straw is short, but the ear has always a full and prominent appearance, and weighs, on an average, 5lbs. in a bushel more than other wheat.

" It is not so liable to be destroyed by the rust or smut; it never lodges in a wet season, and may generally be cut by the sithe; the grain is large, plump, and of a firmer texture than that of any other wheat with which it has been compared, and its early ripening renders it less liable to sprout in the field, either before or after it is cut. Being cleared off early, it affords more time for preparing the ground for succeeding crops. Being a winter grain, the best time of sowing it is about the first of September.

" It would therefore be an useful acquisition to those countries which have summers so short, or climates so humid, as to cause many impediments to the culture of wheat. My reliance on the success of this species of wheat is so firm, that I have sown it at different intervals from August to December, and have thus hazarded upon it a considerable portion of my crop.

" I have the honour to be &c.

(Signed) JOHN TAYLOR."

Essex County Virginia, March, 1794.

Should I succeed in procuring from Virginia a sample of this valuable grain, it shall be communicated to the Board of Agriculture.

No. LXXXI.

Dibbling.—*By Mr. William Curtis, of Lynn, Norfolk.*

At the time when I broke up my land, dibbling was scarcely known; but I have since, both in my own and in my neighbour's practice, seen so much of its advantage in both wheat and oats, over broad-cast and every species of machinery, that I would in the strongest manner recommend its general use. Where the soil is in any tolerable state of fertility, ten pecks of oats and seven of wheat will prove an ample seed per acre. The holes where the seed is placed, should be filled up with a hurdle drawn with thorns, and not with harrows as is frequently practised. The first will merely fill up the cavities, while the latter will very much displace the seed.

Seed.

A neighbour of mine had a piece of wheat which was so extremely mildewed, that it scarcely paid for thrashing. The wheat itself was so shrivelled, that it weighed but thirty pounds per bushel. Nothwithstanding its unpromising appearance, a farmer in a neighbouring parish purchased some of it for seed. The produce of this wheat, which seemed deprived of all its vegetative powers, was equal in sample and quantity to any that the whole parish furnished. But before seed of this description is hazarded for a crop, it is certainly advisable first to plant a few grains of it in a garden pot in a warm situation; but the farmer that I speak of, ran all risks without this prudent trial. If seed of this kind is equally efficacious with that of a fuller body, the advantage is certainly on its side, in the exact proportion that a smaller quantity will seed the land.

No. LXXXII.

Dibbling.—*By Mr. George Pung, of Ballingdon Hall, near Sudbury.*

The advantages of dibbling, in the saving of seed, will be more than the expence; it employs children, who would otherwise be unemployed. The treading of light land is certainly beneficial; if any weeds are found among the corn in the spring, there is less trouble in hoeing them out. It is not so likely to be laid in bad weather, having a better hold of the ground, and the straw is stiffer. In reaping there is not so much scattered on the ground; and I have never seen wheat dibbled, which did not produce as good a crop as the broad-cast when sown in the same field.

No. LXXXIII.

Dibbling.—*By Mr. William Jones, of Fox-down House, Wellington.*

I have more than once had wheat set by hand at various distances, with a dibble, and have found one peck per acre to produce more than six, when sown; the value of the seed-corn saved, at 8*s*. per bushel, will pay the extra expense, and prove a great national saving when it can be practised; but it is a work of time, and requires a very dry season to do it in, without which it is scarcely practicable. Wheat thus set is sure to produce a long ear, and to stand up in the wettest seasons, which are two circumstances favourable for a good crop.

Time of Sowing.

I know from experience, that the success of the wheat crop depends much on the corn being sown when the land is in a proper degree of temperature, which

is universally allowed in this neighbourhood by the adage, "you had better be out of time, than out of temper;" that is, you had better sow your land later, than before you can get it into a proper state of temperature. On the question, what this proper state is, I have differed in opinion from a great majority of the farmers here, who say, that in wheat sowing, "the mire should hang about the heels of the ploughman;" or in other words, that the legs of the cattle should be plaistered with mud as with mortar. This I deny, for I am now treating of heavy wet soils; but they indiscriminately apply it to such, as well as light dry soils; but if they had reserved the application for the latter only, they would not have erred much, because these should be worked wetter than heavy lands; but they apply it to heavy lands, in error, and persist in the practice, for no better reason than that they have been accustomed so to do. The very wet season of 1799, however, in sowing their wheat (which could not be avoided), I should suppose will convince some of them; for to such a wet season as we then had, is to be imputed the failure of the late crop of wheat here, as also a total loss of the barley crop in the heavy lands, which did not get dry in the spring, but continued wet and cold, and of course worked very unkindly. After the barley was sown, a continuance of dry hot weather baked these lands so hard and dry, that very little of the grain vegetated, and what did, had its roots so confined by this hard impenetrable soil, that they could not possibly expand, or derive any nourishment. The consequence was, that the heavy wet lands in this and the adjoining parish, did not produce so much barley as was sown. One gentleman, on whose veracity I can depend, had not one peck out of five acres. The barley, which did not vegetate in the spring, came up very thick after harvest, and is now to be seen in all these lands. Although I had a good crop of barley in better soil, yet a great deal of wheat was sown which did not grow till after harvest, in so much that if we have no severe frost, I think to let it stand for a crop the ensuing season. Having stated that I differed in opinion from the great majority of the neighbouring farmers, and produced proofs of their opinion being wrong, as to the proper temperature of soils, from the wetness of the seed time they experienced in 1799, and the consequent failure of their crops, it is incumbent on my part to prove, from some experience, that mine is right. It happened in the year 1785, that I had three acres of fallow land in a forward state of preparation for sowing wheat, on which the manure was thrown abroad, and ridged up the first week in October, ready to be sown. I was prevented however some days from

sowing by some of the neighbouring farmers assuring me that I could not expect half a crop, as the land was too dry, and that I had better wait for rain. But having met with an old farmer of equal experience, and perhaps more observation than my other advisers, I asked him if he had sown any wheat; he answered me no, for his lands were not ready for it, but he should be glad if they were, because some years before he had sown ten acres so dry that the dust flew over the backs of his plough cattle, as much as he ever saw it in barley sowing, and that he never had such an abundant crop before or since. I replied, if that was the case, I wondered that a man so provident as he was, should not always have his lands ready in the early part of the season, so as to be enabled to sow before the autumnal rains sat in. He answered, that his lands were so wet and heavy, that there were but few seasons in which he could find them dry enough to break up so early as he could wish, and to plough them before, would be to make more haste than good speed, for his land was "all mire or all ire:" so that a man farming such soil, should be ever watchful of the opportunity to work it; and I have known, said he, many, who either from negligence or want of judgment, lose their wheat crop in such situations.—This conversation determined me to sow my three acres, worth about 20*s.* per acre, with wheat the next day, 10th October 1785, remarkably dry. The produce was $97\frac{1}{2}$ bushels of marketable wheat, $32\frac{1}{2}$ bushels per acre, to the astonishment of the neighbouring farmers, who dissuaded me from sowing it so dry, and who waiting for rain, had scarcely half the crop. I have ever since endeavoured, as much as I possibly could, to sow when the land is dry, which experience, added to the observations I have made on other farms, fully confirms my opinion.—The wheat was scarcely ever put in more dry in this country, than the last season, from which I will venture to predict an abundant crop next harvest, in heavy lands. The fact remains to be proved, but I now state my opinion as to the event, for I am well assured that making a good fallow, or reducing the heavy land to a good tilth and sowing it dry, is of more consequence to the ensuing crop than a good manuring without it: to say nothing of the profitable advantage to the subsequent crops on account of the land being not trodden in the wet.—In the year 1786, I drained the half of another field of three acres, and being disappointed by a person not bringing stones in time for the other half, I could make a good fallow of the part drained only, the other half being wet; though managed in the same way, I could not reduce to a good tilth, or destroy the old sod, which remained in large pieces.

The consequence was, that I had thirty-nine bushels from the half that was drained, and scarcely ten bushels from the other half which was not drained. This I imputed to two causes; first, the land being so wet and lying so hollow, that the furrows could not draw off the wet; and having no draining gutters to assist them, the water stood in pools, and a severe frost setting in killed a great part, and some could be plainly perceived to be eaten off by worms, which without doubt must have remained in the old sod, which the harrows could not get abroad, being wet and tough, and which I have found from this experience, and subsequent practice of having such sods cut abroad by manual labour, amply to repay the expense.—In the year 1787, I drained another field of three acres, which being a better piece of land than the former, I thought of getting a crop of fallow turnips before the wheat; but I found that I lost more by my crop of wheat, than I gained by the crop of turnips, though a good one, the land being so trodden by the sheep in feeding on them in the wet, that I could not sow it in what I deemed a proper state of temperature; and the season being far advanced for sowing, I was under the necessity of sowing it when the mire literally hung to the heels of the plough. The consequence was that I had but fifteen bushels of wheat per acre, although it had the usual manure of lime and earth for the turnips as the other fields had for the wheat. But my loss did not stop here, for I found this field, on ploughing it for barley, to turn up so close and heavy, in consequence of having been * trodden in feeding off the turnips, and in sowing the wheat, that I had but a scanty crop of barley, about sixteen bushels per acre, on which there fell a good deal of rain in harvest, with some intervening days of hot sun shine; the effect of which was, that the barley grew, and to my surprise, that more than an acre in the middle of the field was turned to malt, as completely as if it had undergone the usual process in a

* It may be said, Why were not these turnips carried off the land? I answer, that horses and carts would injure it much in drawing them out, and the crop of wheat be deprived of the manure; besides, turnips should be fed off the land; they grow not only for the improvement of it, because I am convinced from my own observation, corroborated by the concurrent testimony of some very experienced farmers, that although turnips get dirty by treading of sheep, yet they fatten faster than when they are carted to a clean pasture field. If any person should be of a different opinion, the experiment is easily tried, by a certain quantity of sheep being kept on the turnips, and others of equal condition, being fed on turnips carried to them on pasture land that has been eaten down bare. I think the experiment will carry conviction with it. But horned cattle, when fatting, should have them carried to their stalls, washed clean, and cut for them.

malt house; that near the hedges, not drying so fast, continued growing longer, and was fit only for hogs. All that I could collect for malt, I put into a barn to thresh out immediately, which was done with some difficulty, on account of the roots of the grain so insinuating themselves about the ear, but that which did come out in threshing was the best of it, and I determined to have some beer brewed with it, if I could be permitted to have it dried on a malt kiln with propriety, without being subject to the duty; I therefore communicated the circumstance to an officer of excise, who told me, that as it had not undergone the usual process in a malt house, no duty would be payable on it. I then sent sixteen bushels of it to a malster, to dry, and had it brewed into beer, which proved no way inferior to beer brewed with other malt: not in my opinion only, but in the opinion also of some who, from the novelty of it, ridiculed the idea of brewing it. Some of the neighbouring farmers who had barley down at the same time, finding some of theirs in the same state, afterwards applied it to the same purpose with equal success. The adjoining field of three acres* I ploughed the next year, 1788, and sowed it with flax, except about eight feet from the hedges, which I left to mix with lime to manure the wheat crop. The flax proved an average one, and as soon as it was carried off, the ground was ploughed to be fallowed, but having lost the time while the flax was growing, that had been better employed in fallowing, I could not get it to a tilth, which was apparent in the crop of wheat producing only seventeen bushels per acre. The practice of the late tenant was always to take a breaking crop of oats, but I never saw him have a good crop of wheat after them; and my experience has taught me that such lands should have no breaking crop, but have the advantage of the whole summer to give the opportunity of working them at proper times, and to be manured with lime mixed with earth; and the fresher the lime from the kiln the better; for it should not be drawn to a heap, as is the practice of some injudicious farmers, many weeks before it is used.

* In breaking it up, to my great surprise I found large lumps of red marl under the furrow, distinct from the soil; and I enquired of the late tenant if he could account for it. He replied, he had heard that a former tenant had, twenty years before, marled the field, and ploughed it down; but he did not seem to be aware, that though marl, by the influence of the air, will slack when exposed to it, would, when turned under the furrow, remain to the end of time in the same state. *Rudis indigestaque moles.*

No. LXXXIV.

TIME OF SOWING.—*By Mr. Charles Wedge, of Westley Bottom, near Newmarket.*

I MUST mention, that on the first day of August, which was the day I began to sow rye, I sowed an acre of wheat, which was by far the best of any I had that year: it was quite free from mildew, and I have found by experiments for many years, that sowing early, and pretty thick, is the only way to prevent wheat from mildew.

No. LXXXV.

SPRING.—*By the Rev. Joseph Scott, of Chatteris, Cambridgeshire.*

ALL loamy-soiled grass lands, that lie low on a clayey substratum, will bring excellent wheat, if sown early in the spring. The furrows however should be neither thin nor broad, if sown broad-cast; and if such wheat is dibbled in, a bushel per acre will do as well in spring as two bushels would do sown broad-cast in autumn. I saw several excellent crops of wheat in Huntingdonshire, that were sown last spring on loamy soils. The land had been grazed many years before, and was only ploughed once, and then sown immediately with wheat.

No. LXXXVI.

Turnips among Wheat.—*By Mr. W. Whiteborne Dark, of Holdsworth, Devon.*

A thought having struck me many years ago, of sowing turnips among wheat, I sent my man in moist weather up and down the furrows, sowing about a quart of seed per acre, at the time of the wheat getting into ear. This had the desired effect, though the tops in cutting the wheat were in several instances nearly cut off, yet the turnips grew so fast after that, they were valued at that time at £5. per acre. Several of my neighbours observing this, took the hint, and managed with the same success; but it must be observed, this will not do unless the wheat has been sown on very old meadow or pasture, not naturally rich, and after paring and burning (for obvious reasons), the least grass or weed wholly defeating the purpose.

No. LXXXVII.

Wheat on Peat.—*By Mr. John M'Kenzie, of Glasgow.*

In moss, after a crop of potatoes had been taken, for which the ground had been previously well sanded and dunged, I have known wheat ploughed in six inches, and the returns above nine quarters per acre; and I believe it was the first wheat that ever grew in Great Britian in moss.

No. LXXXVIII.

HARVEST.—*By Mr. William Elmhurst, near Horncastle.*

I LIKE to have my wheats cut rather green, not to stand till ripe, so as to shake; and I always have mine bound in smallish sheaves, set eight only together; four of the largest, two against two, and the two smallest at the ends, so that they prop and support each other; and the two longest tied ones, opened well and drawn up close to each other, over the other six; and by so doing, I scarcely ever have a stack blown down, even with a very strong wind; the two cap sheaves must be tied together by twisting, and a little of the but ends of the sheaves (on both sides) together; and when that is done, and the cap sheaves spread nicely over the other six, neither wind nor rain will hurt the wheat, if it stands out for three, four, or five weeks, being so well covered below the ties; for no one practical failing, in a farmer, is greater, or more ridiculous and injurious, than carrying his crops, of any sort, too hastily; as there is ten times more corn injured by being in too great a hurry, than by its stopping too long in the field; and when wheats are cut rather green and covered, as above, the straw will feed the corn, and make the flour better and finer.

No. LXXXIX.

HARVEST.—*By Mr. Robert Moyle, of Marazion, Cornwall.*

As soon as the wheat is bound into sheaves, and the weather assumes an unfavourable appearance, the husbandman first forms a shock, composed of fifteen or twenty sheaves standing upright; against this shock he lays a sheaf with the but end nearly flat on the ground, and the ears rising or leaning against the sides of those standing

erect; this he continues to do till he has a complete circle, and then begins another row, keeping his knees on the last sheaves, till two or three hundred sheaves are disposed off in this manner, taking care to give the ears an increased elevation, so that the whole, when finished, shall exhibit the appearance of a spire, being taper from bottom to top, and from ten to fifteen feet high: the upper part is greatly contracted by increasing the uprightness of the sheaves, and the whole is covered with a sheaf of reed, called a cap, which is bound down by a straw rope, and completely prevents the corn from being injured by a long continued rain. In these parts this is called an *arrish mow*, and deserves the attention of farmers residing in those counties where such a practice is novel. An assistant is required, to hand the sheaves to the builder by means of a pike.

II. OF OATS.

No. XC.

SORT—POLAND.—*By the Rev. Joseph Scott, of Chatteris.*

POLAND oats are always ripe several weeks before wheat in the same district; and as oat bread is eaten in many parts of the united kingdom, and would be soon in others, should the old wheaten flour fail, before new wheat flour can be brought into consumption, and especially as by water carriage oats may be easily conveyed from the southern parts of the kingdom to the most northern; therefore Poland-oats should be sown on all loamy soils, and especially on the earliest in the southern districts. But as Poland oats are sown the least in the southern counties, therefore I will presume again most humbly to entreat noblemen and gentlemen to use all their influence to cause Poland oats to be sown this spring, as soon as possible, especially on the most loamy soils; because such a crop could not fail to produce a most seasonable supply.

And let such loamy grass lands, as are ploughed for Poland oats, be ploughed rather a thick narrow furrow, and then the seed, if sown broad-cast, will be better covered, and the rows not too wide from each other.

About four bushels and a half per acre is a proper quantity of seed, if the land be sown broad-cast, and three bushels if dibbled, on any rich loamy soil; but if the land is poor, it will require rather more seed to an acre.

No. XCI.

SORT—POTATOE—RED.—*By Dr. Bryce Johnston, of Holywood, Dumfries.*

THE potatoe oat is a beautiful, short, thick, plump oat; more shaped like very short plump barley, than oats. It produces, on very rich good land, a great quantity of bushels, and is more productive of meal than any other oat I have met with; but it is not productive of straw, and is more easily shaken than the common white oat. Of all the early oats, for good and rich land, the red oat is the best; it is of the shape and size of the common white oat. Its produce, both in corn and meal, is nearest to that of the potatoe oat; and its straw is superior, both in quantity and quality. It is also less apt to be shaken by the wind than even the common oat. It is the only early oat that has this quality.

No. XCII.

SORT.—*By the Rev. Robert Duncan, near Kilmarnock.*

VARIOUS kinds of oats have been mentioned by different persons, and I have good reason to believe that different names have sometimes been given to the same species: there is however a great variety of this grain. The white oat is chiefly cultivated in this part of the kingdom; some indeed sow the "blainsley;" and a few, the early oat. I use all three, though most of the latter, on account of the soil. The early oat is a little plump grain of a reddish colour, and thin husk; the blainsley is smaller than the white, thinner, and fairer in the skin; the early oat ripens eighteen days, and the blainsley nine days at least, before the white. The straw of the white oat is the most palatable fodder, but long experience teaches me, that the difference is not so great as some have supposed. The early oat, after

being much wetted in the shock, is more apt to shake out with handling than the other two; but it is admirably fitted for low rich grounds, or for any grounds, where there is apparent danger of the crop falling down and lodging from its luxuriancy. The early oat bleeds better from the sheaf, and usually weighs two pound per bushel more than the white. These circumstances must give the early oat a decided preference in all lands suitable for it, especially when it is considered, that even at equal weight it yields more meal, as good in quality, though not so fair in colour.

I have now before me an exact account, which I have regularly kept for sixteen years past, of all the oats which I have milled, and their produce in meal, in different columns, under their distinct heads of time when sent to grind; number of quarters; species of oats; weight per bushel; and quantity of meal. From the whole collected, it appears that white oats, at thirty-six pounds avoirdupois per bushel, yield eighteen pecks of meal per quarter; that early oats, at thirty-eight pounds and a half per bushel, yield twenty pecks per quarter; and that the blainsley, holds the middle station between them.

Ten years ago, being at the house of a very respectable gentleman in this neighbourhood, he told me that, a day or two before, he had received two quarters of oats of a very superior quality, which a friend had sent him from London; that they were called Church's oats, and that he would give me three or four bushels of them for seed. I thanked him for his kind offer, but would by no means accept of it till he had more of the oats to spare, after reaping a crop of them. As it was then dark, he ordered his servant to go into the barn to grope for such a sack, and bring in a handful of the oats. I was never more struck than with their external appearance, being almost as large as barley. I put a few grains of them in my pocket, and when I came home I sent my servant, without a light, to fetch me a handful of white oats out of the first sack in his way. There was, in neither case, any choice of the grains. Taking the gold-scales in my hand, I put Church's oats in one scale, and counter-balanced them with oats in the other. Clearing the table, and throwing down the contents of the two scales on opposite sides, I found that sixty two grains of Church's oats, were equal in weight to seventy three of the white; then carefully taking the husks from each, and returning the kernels to the scales, I found, to my astonishment, the kernels of Church's oats so light, that I was obliged to throw out ten of the white to restore an equilibrium.

Next morning I sent word to the gentleman, what expectation he might have of Church's oats, even from this diminutive experiment. The consequences were the same upon a larger scale, after he had reaped his crop. He has never sown them since that time. However, I would not wish that such a beautiful grain should be entirely discarded: I think it might produce a good crop when drilled on very rich land, might be an excellent food for horses, and even (*viz.* with barley) for malting, when God in his kind providence may be pleased to command times of greater plenty to return.

No. XCIII.

Seed.*

At the usual season, I would sow strong land with five bushels per acre at least, of that kind of oats generally known by the appellation of Angus, and which are perhaps the best sort for cold wet bottomed lands. In the whole course of my practice I have uniformly found them to be so. If it is intended to sow Dutch or Poland oats, the quantity necessary for each acre will be six bushels at the least; and, whatever theorists may say, even seven bushels will not be found too much; for the consequence of sowing upon old grass land, where it is probable a great portion of the seed will be destroyed by vermin of different kinds, is very different from that, after turnips for instance, where almost every distinct grain may reasonably be expected to vegetate.

* No name.

III. OF BEANS.

No. XCIV.

BEANS.—*By Mr. John Sherif, of Haddington.*

THE writer begs leave to say a few words on the subject of harvesting in general, and that of beans in particular. This crop should be cut down as soon as the eye has attained its deepest dye, and instantly, if dry weather, sheaved; the sheaves of any grain or pulse ought not to exceed nine inches in diameter; and he thinks that sheaves from six to eight inches, would be far safer in this variable climate. By cutting at this period of the state of the crop, the bean straw will be of triple value of what stands till the leaves fall off; the grain too will be superior to that bleached by the weather for weeks, after the haum and grain of the first is secured in the rick. Shocks of any crop of grain ought not to exceed six sheaves of the above mentioned size.

IV. OF TURNIPS.

No. XCV.

TURNIPS.—*By the Rev. J. W. Parsons, of Upper Hadnock, Monmouth.*

LAST year I was sensible of the dry state of the ground, and unwilling to delay, as husbandmen usually are, I therefore divided the turnip seeds into equal parts. A mixture of nitre, sulphur, and common salt, was thrown on one half, enough to absorb the water with which it was previously moistened. This prepared seed was then mixed with the other half. At the close of each day's ploughing, one pint to a statute acre was sown before the first harrowing, and another before the last harrowing. In this way three acres were sown on one field, and three in another, nearly half a mile apart. They vary in the quality of soil, and were unequally manured; both succeeded alike in producing an ample stock of plants, which escaped the fly, and turned out a very good crop. Eighty acres adjoining these fields, nearly of the same quality, and fallowed with the utmost attention and in the best manner, sown at the same time, and with the same seed, but unprepared, and not immediately after each day's ploughing, totally failed, and I believe were resown twice afterwards to no purpose. One fact is worth an hundred arguments; and this induces me to think, as I preconceived the event, that it is a certain way, in a dry season, to procure a crop of turnips, to sow a mixture of prepared and unprepared seed; and above all, to sow at the close of each day's ploughing on the fresh earth.

No. XCVI.

Drilling.—*By Mr. J. Sherrif, of Haddington.*

A machine for drilling turnips on ridges has lately been invented; it drills two drills or ridges at once, which it also rolls before and again after the seed is deposited, and all at one operation. This it will do at any depth or width, not exceeding that of the loose mould and length of the large roller. It is drawn by a single horse, and driven by a man, or even by a smart boy. It is a most decisive implement, well adapted to the purpose: ten acres may be easily drilled in a day with it, and rolled into the bargain. The writer has one, it only costs about £4. rollers and every thing complete.

No. XCVII.

Drilling.—*By John Morris, Esq. of Glamorganshire.*

I have seldom met with any soil too strong to bear turnips, to a certain degree of advantage, provided they are sown in drills, so as to admit of being ploughed between the rows; and more especially if they succeed a crop of potatoes properly treated. Clay soil is in some cases too adhesive to be managed in an husband-like manner, with the common hoe, either with a view to the growing crop, or to the ameliorating of the soil for future produce.

In all strong loamy soils, I have likewise found it most advantageous to follow the mode of drilling turnip seed; afterwards ploughing between the plants, and then setting them out at proper distances with a hand hoe.

No. XCVIII.

Rolling.*

My method is, after putting my land in proper order, to roll it as hard as possible when dry, and then to sow the seed; and if the weather continues dry, to roll it in, but if rainy, to let it take its chance. I never fail in this way to get a sufficient number of plants to stand; and as the moisture is so much better retained to the root than by leaving it worked up lightly, to filter through quickly, at a season of the year when rain may be least expected, and the weather is at the hottest, I conclude, that it may be by far the best mode for general practice. Having repeatedly argued on the absurdity of the established mode as already explained, I gave proof of my ideas after the following manner. I caused a piece of clayey land, in my garden, to be well manured, and planted at autumn with cabbage plants. The following summer, one half part thereof was dug and worked up as fine as possible; to the other half, nothing was done but clearing the stalks and weeds, and with a rake a little earth through its hard state was with difficulty obtained, so as to cover the seed from the birds; each part was sown at the same time, and on each the crop was remarkably fine, but the part which was not worked was rather the best; the difference however was but very trifling, yet it so rivetted my opinion, that I frequently sow cabbage and onions, without any farther trouble than hoeing the ground, and raking off weeds, and beating in the seed, and it answers as well as in any way whatever.

* No name.

No. XCIX.

CONSUMPTION.—*By Mr. W. Wright, of Ranby, near Retford.*

UPON land properly calculated for turnips, I am an enemy to carting off, having often known a loss sustained by the ensuing crops, more than equal to the extra profit of carrying off. Where turnips are grown on very light sands, fallowed from swarth, I have observed the good effects of feeding them with cattle on the land; the weight of the cattle upon it, has a tendency to fasten or compress the soil, much more than sheep, which is a desirable circumstance on such soils. In proof of this observation, I will state an experiment made by a neighbour of mine: he had a field of turnips on weak sand land, and fallowed out of swarth, the whole of it had previously been under the same management, and if there was any difference of soil, the cattle had the lighter side of the field for the sake of compression: it was divided equally, and one side was fed by cattle, the other by sheep; the result was, that he reaped above one-third more of barley in his ensuing crop from the side on which the cattle had been fed. However, I must observe, that the eating with cattle will not hold good on the best turnip land, sheep being there found to be the most proper stock for profit, and also for the improvement of the land.

No. C.

CONSUMPTION.—*By S. Deverall, Esq. of Clifton, Nottinghamshire.*

ON dry sands, chalks, dry loams, and gravelly soils, it has been long established by experience, that sheep stock always thrive faster when fed upon the land, than when their food is carted off. At the same time they materially improve the soil for the ensuing crop, not only by returning the produce to the ground, but by

giving a greater tenacity to such soils. Beasts may likewise be fed upon the land to advantage on the dryest soils. But on all other soils, except the fore-mentioned, if turnips, or other winter crops for cattle and sheep are sown at all, the advantage is much in favour of carting off, though in either case it is sacrificing a necessary to a luxury; the advantage immediately arising from such crop being generally more than counterbalanced by the deficiency of the following corn crop.

V. OF CABBAGES.

No. CI.

CABBAGES.—*By Mr. Amos, of Brothertoft, near Boston.*

PLOUGH ridges four inches and half deep, then grip or drain it completely. About the middle of March, plough four inches deep the cross way of the ridges. The beginning of April, drag-harrow both length and cross ways. The latter end of April, roll and harrow alternately twice in a place. Gather the couch grass, if any. The beginning of May plough the land into four feet ridges, which must be rolled down as they are ploughed. As the season of planting cabbages extends only to this month, all the previous operations should be timed accordingly. In the second week, lay on the dung at the rate of ten or twelve tons to the acre; spread it in the open furrows; then plough the ridges back again over the dung, and roll them down with a one horse roller, so that the horse may walk in the furrows. Plant the cabbage plants in the middle of the ridges, twenty-eight inches asunder. About the middle of June, plough a furrow off from the cabbages, on each side, making a ridge in the intervals; the cabbages will then stand upon a flat ridge of about six or eight inches broad. These ridges must be well hand-hoed, and the clean earth drawn up to the cabbages at the same time. The latter end of June, the earth must be returned to the cabbages again. The middle of July, scour up the intervals with a double mould board plough. This operation should be repeated again the beginning of August. If any more weeds appear, they must be pulled up by hand, and the caterpillars (if any) killed at the same time.

This is a most invaluable plant, very productive, accessible at all times, and is an infallible supply for sheep-keeping during the spring months, especially for ewes in lamb. Beasts and sheep are all exceedingly fond of cabbages. One year I planted forty-six acres, upon some of which I had fifty tons weight of cabbages per acre.

VI. OF WINTER TARES.

No. CII.

CONSUMPTION.—*By Mr. James Malcolm, Stockwell Place, Surry.*

IN the month of May tares will, in ordinary seasons, be fit to be fed off. Sheep should be folded on them, the manner of doing which is not generally known, and if known, is so very seldom practised, that I scarcely ever saw above two or three instances, where any thing like a prudent plan was adopted. I may therefore be excused the liberty of entering more into a detail on that subject. The month of May is a period of great and natural anxiety with the flock as well as stock farmer; he finds in this month very great difficulty to procure the necessary food to keep on his flock after turnips; and he either has recourse to some common, if near at hand, which by the bye is only keeping them alive, or else he must give up some of his best pasture or meadow for their use. But if he be provided with a good succession of tares, he hurdles off a certain portion of them, and turns his flock into that part so hurdled off. These animals, with stomachs as voracious as possible, rush into the field, and instead of eating up the tares clean and all before them, trample and destroy more than they eat; it is just the same with clover; instead of which, let a certain portion be cut across the field, as far as occasion may require, and you have hurdles and stock for the purpose. This first allotment should be mown, and carried clear off the field; either into a nice well littered yard, apart from the neat cattle, and put into low racks; these racks to be moved about the yard at every replenishing; and which, by the immense quantity of urine provoked by the tares, they will nearly saturate the yard. I prefer this mode to feeding them in a close; because dung, at any distance from a large town, is an article of so much value. A portion of the tares may be given *de die in diem* to the neat cattle and cart horses in the yard. After a sufficient space of ground is cleared, the shepherd

must cut some fresh tares, which he will place in racks, and distribute over the ground that was first cut; moving the hurdles forward as often as necessary, until the whole field is fed off, and dressed alike. Between Morton on the Wold and Tewksbury in Gloucestershire, I have observed them using a hurdle, or what is more generally called a wattle, made of oak, leaving out the middle rail, for the purpose of dividing off the land, and enabling the sheep to put their heads through and feeding themselves. In order to keep the sheep separate and at the same time to give strength to the wattles, a certain number of upright laths are placed at equal distances, sometimes four, in others five, and these are well secured by pins to the cross rails. I do not however altogether approve this scheme; for in the eagerness with which sheep feed, and as by this mode the whole force, if not weight, of the animal is opposed to the hurdle or wattle, it is not an unusual thing to see them drop, and remain unable to move for a long time. These wattles also are very expensive, being at some places as high as six shillings each; the former mode has the advantage. If from the heat and dryness of the weather the tares cannot be fed off fast enough, that is, before the blossoms begin to decay, they had better be mown and made into hay, which if well managed will produce the sweetest and most nutritious of any in the farm. I have grown from two to two tons and a half on an acre; and sometimes more upon a smaller scale; and when cattle break into the rick yard, I have always found them leave good clover, meadow, or trefoil hay, untouched, and feed upon the tare hay; a proof this, beyond all the arguments or treatises in the world. In fattening off old ewes and wethers, and in improving of lean neat cattle, I know of no sort of provender so valuable.

VII. OF POTATOES.

No. CIII.

POTATOES.—*By Mr. Thomas Baldock, of Burwash, Sussex.*

POOR commons, when got into a good state, will turn out excellent potatoe grounds; but they will rob the soil very much. I have indeed cultivated potatoes more than twenty years; I often used to fatten hogs and bullocks with them, and they certainly are often a great help; they save much hay and corn, but I know not that there is any great profit in them; yet as part of our food, they should be cultivated and used.

No. CIV.

SHOOTS.—*By Mr. John Wright, of Pickworth, near Stamford.*

WITH the rest of the potatoes planted last year, I planted a bit for comparison with the shoots which issue from potatoes before planting in spring. The shoots were about the thickness of a goose quill, and from three to six inches long, planted with a dibble at the same time, and same distance as the cuttings were. They all grew without watering, the same hoeings were given to each, and they were taken up at the same time. The result was in favour of the shoots, both in tops and roots: by this means seed potatoes cost nothing, and for ground in good tilth shoots are as soon planted. I this year intend to plant ten acres, and shall endeavour to procure all the shoots I am able. A piece of three acres, which was potatoes last year, shall remain in its present state until the beginning of May, at which time the

potatoes missed in the digging will be up, and shall be taken up and replanted; other pota oes might be laid in cellars to induce them to shoot. Let no one be deterred from pursuing this valuable method; I speak from experience, and from every part of the business being performed with my own hands. In this method, every acre of potatoes planted at two shillings per bushel, will save in the planter's pocket £2. and twenty bushels clear produce to the country; a consideration at all times to be attended to, but which in a season of scarcity ought to be particularly noticed. Some persons may suppose, that such potatoes as have produced shoots, will not be fit for use; but I assure them they will, though they may not be quite so good as others. Half the potatoes exposed for sale in the spring have had their shoots rubbed off, though the latter are not converted to use. I intend this summer to make an experiment with one acre of burnt ground, by spreading over it ten quarters of lime, at the time the ashes are spread for the turnips. This I conceive to be the best manure for this ground, as it being of a cool nature, may counteract the too caustic quality of the ashes in dry burning seasons. To sow corn late, is the greatest error a person can commit in this sort of land. Let it be sown early, that it may get cover before the parching weather arrrives; for this hot dry burning land, the heat of the ashes, and the heat of the season, if backward, must destroy it. Another acre contiguous shall be measured off, and each threshed separately; such experiments are troublesome, but may be of great importance. Should the Board, wish to have any particular experiments tried, which they conceive may be of public utility, and will trust me with the excution of, I can only say, they shall be executed with all the zeal and accuracy my abilities will admit of; nor shall I expect any emolument therefrom, except attended with any particular loss.*

P. S. I have just invented a machine for dibbling all kinds of grain in rows, with intervals of any size between the rows from six inches to three feet. A machine of this description has long been wanted, as nothing but the heavy expense attendant on the present mode of dibbling, has deterred many from pursuing it. Dibbling in the present mode costs about twelve shillings per acre; by the machine it will amount to less than two, if it answers my expectations. It has not yet been tried as it is not finished, but it promises in the opinion of agriculturists, likely to answer the proposed end.

* The Board accepted this liberal offer of Mr. Wright, and he has since executed several trials at their recommendation.

No CV.

Potatoes.—*By Mr. C. Ritchie, of Culmore, by Stramaur.*

I affirm, after twenty years experience, that I have often had part of a field of potatoes, and the rest of it turnip, both manured, and both equally good crops. The bear or barley after both equally good; the hay and pasture grass which succeeded, was in all respects the same after both. But when broken up again, and sown with oats, that part of the field which had been potatoed, carried the best crop. It is however but fair to state, that the potatoed part of the field being generally on the side of the field where the cattle, while it remained in pasture, rested much, might be thereby more copiously manured from their droppings.

No CVI.

Sort.—*By F. Kirchoffer, Esq. Dublin.*

Of the seed potatoes that were planted in a field, there were just thirty-two hundred weight, which I procured from the South of Scotland, at a very considerable expense. These were a clean white and good kind, a little flatted, and had been raised in a moist soil. They were planted in some of the drills. Some more were planted with white seed, raised in the Bog of Allen. Some were also with black, and a few with very fine apple potatoes, from the same quarter. The remaining drills were planted with white, black, and apple potatoes, all of which had been raised on land very similar to that in which they were now put; in fact, they had grown in the very next field.

In their growth the Scotch seed made the earliest and by much the most luxuriant

shoots; the Bog's whites and blacks were the next best. The home blacks, and Bog apples, were the next; and the home apples were the worst of all.

As the Scotch whites were the earliest, so they were the first that were dug out; and here the produce was astonishing to the workmen, and to numbers of strangers who came to see the digging. They lay in the drills like hanks of onions, from the bottom, on which the seed had been laid, to the crown. There was very little difference in their sizes, none either remarkably large or small, and they turned out of the ground as clean and beautiful as possible. A great number of the roots produced from two to three and four pounds each, and several were more abundant. I had scales brought to the field, and before respectable witnesses six perches of each kind of potatoes were dug out of the drills, three of which were such as were supposed to be the best, and the other three the worst, but in fact they seemed to be pretty equal. The weights of the produce of the six perches of each kind were as follows, *viz.* (the perch seven yards)

	lbs.		lbs.	
The Scotch whites	312	which averaged	52	each perch.
Bog whites	246	- - -	41	ditto.
Bog blacks	210	- - -	35	ditto.
Bog apples	138	- - -	23	ditto.
Home whites	192	- - -	32	ditto.
Home blacks	162	- - -	27	ditto.
Home apples	108	- - -	18	ditto.

All the drills were thirty-eight perches long and five feet distant from centre to centre; of course they were eighteen times thirty-eight perches of drills in an Irish acre, or 684 perches of seven yards running measure. This number, multiplied by the average of each sort of seed produced in a perch, gives the acreable produce of every kind in pounds, which reduced into barrels of two hundred and a half, is as follows, *viz.*

The Scotch whites gave	126	of these barrels	per acre.
Bog whites —	100	barrels.	
Bog blacks —	85	barrels.	
Bog apples —	56	barrels.	
Home whites —	78	barrels.	
Home blacks —	66	barrels.	
Home apples —	44	barrels.	

Nothing more need be said on the very great importance of change of seed in the potatoe culture. This statement of the produce of various kinds, under equal advantages, must show it in the clearest manner, and is perfectly consonant to my former experience.

No. CVII.

Scoops.—*By T. J. Rawson, Esq. Cardrington, near Athy.*

The scarcity of seed potatoes last season induced me to cut off about a tenth part of all that were used in my house, as they were brought to the kitchen, at the end where the eyes are in a cluster, and then to subdivide the eyes, which produced three, four, or five sets from each potatoe; no matter how small the eye if it be entire. I planted these sets, and had every increase I could wish: I should prefer them to the small potatoes sliced, which are commonly used. No injury is done to the remainder of the potatoe, provided the cut be made immediately before boiling. I have already saved seed for two acres of drills, without either expence or trouble; many of my neighbours are now saving their potatoe seed in the same mode.

No. CVIII.

Starch.—*By the Rev. Dr. Robertson, of Granton, near Edinburgh.*

In converting potatoes into starch, there is an easy process, which I shall note. I have found the fine-eating mealy potatoe to produce 4lbs. from 28lbs. but from the red yam only 3lbs. from the same quantity of roots, which is also in the inverse proportion of the quantity produced of each from the load, which seems to reduce both to an equal value: yet this yam, perhaps, from containing more saccharine juices, for it is really sweeter, goes farther, acre for acre, in feeding cattle.

Potatoes or yams are converted into starch merely by grating them down into a pulp, which is then soaked in a tub of water, changing the water every day for a week together, which carries off the refuse as it rises upon it, and putting the whole through a search every day also, which takes out the coarse or branny part; a fine search being used twice the last stage of the process. The residue at last being now quite fair in the colour, is dried in the sun or before a fire.

A ton of yams will produce 240lbs. of starch, and eight tons, an ordinary crop from an acre, will hence produce 1920lbs.; a bushel of wheat produces 20lbs. of starch; and thirty-two bushels, a good crop from an acre, will hence produce 640lbs. which is but one-third of the quantity gained from potatoes. But 2lbs. of wheat starch is worth in using 3lbs. of yam starch; yet still an acre in yams will produce double value in starch that a crop of wheat will do. It is to be observed also that yams themselves are the best preparative for a crop of wheat in succession of any crop whatever.

VII. OF HEMP.

No. CIX.

HEMP.—*By Mr. John White, of Wykeham, near Spalding.*

THE subject of hemp and flax is not comprehended in the enquiries of the Honourable Board: yet I shall hope to be pardoned if I say a few words upon it, because I perceive that useful branch of agriculture to be greatly on the decline. In my neighbourhood great quantities of hemp and flax used to be grown, but their culture is now dwindled to a mere nothing. A few weeks back I was conversing on the subject of hemp and flax with a neighbour of mine, who two or three years ago was a considerable grower of those articles; and respecting the decline of their cultivation, I soon found that we were both of one opinion. His observation was, that in this neighbourhood so little land is allowed to be ploughed, and the price of corn is at the same time so exceedingly high, that people, especially the little farmers, who are not allowed to plough but a few acres, were obliged to cultivate their hemp-lands with corn for their domestic uses, the price being so exorbitant, that if a man did not grow it himself, he could not afford to buy it. The decline in this article (hemp) in my memory, and within these last thirty years, has been wonderful indeed; and it is but a very few days ago that I heard a very respectable man, who is a rope maker, say, that since the misunderstanding with the Court of Petersburgh had taken place, he did not know how to procure hemp at any price to carry on his trade; and I declare that within these last twenty years, I have seen as capital good hemp sold in ——— market at three shillings per stone, as I this day saw sold in the same place at eleven shillings and sixpence. If the growth of hemp and flax are of any serious consequences to this country, as I think it must, then some immediate and effectual methods must be adopted for the restoration of it. The bounty which was formerly granted, of threepence and fourpence per stone upon the growth of it, though in fact very irregularly paid, would not be sufficient at this day to act as any kind of stimulation to the grower. It is not my business here to propose any plan to restore the cultivation of hemp and flax, though I am persuaded it may be done.

IX. OF FLAX.

No. CX.

Flax.—*By Mr. Thomas Smith, of Chibness, Oxfordshire.*

In respect to the course of crops, to make the most advantage of clayey land, flax should be your first crop; but this I know by experience, many, nay, I may say all, landlords will argue against; but I have had the pleasure, by experience, to convince them that they are wrong; for by sowing flax, and that being well attended to, your land is excellently prepared for wheat, your tenant has in the flax an excellent manure for all his lattermath, upon which his flax is laid; he has a rich supply of seed to feed all his cattle; he has abundance of labour for the poor; and at last has, from a good crop, from ten to fifteen pounds per acre to put into his purse, to enable him to be a good tenant, and to give both land and landlord every satisfaction required.

X. OF WOAD.

No. CXI.

WOAD.—*By the Reverend N. Cotton, of Thornby, near Welford, Northamptonshire.*

THE growers of woad always choose a deep rich loam, from which they gather two successive crops. This vegetable strikes its root very deep, and is an exhausting plant. Thirty years ago, such pastures for this purpose were let at four guineas to five per acre, and at this time higher rents are paid. During the culture of this plant, the land is kept remarkably clean from weeds, and in this part of their work the labourers are generally on their knees, whereby the land receives the advantage of being well pressed.

After two harvests of woad, the landlord lets at a rent, double to what was paid for pasturing, the woad fields to be ploughed for corn for two or three years. They have carried great crops of wheat, oats, and barley, and after that have been occupied by the tenant at a price equal to what was given before the pasture was broken up for a term of years. Such soil will recover, by good management, its former goodness in fifteen to twenty years, provided it be well grazed during that period. The writer of this Essay heard a considerable grower of woad assure a gentleman, that his land, just then woaded for two years, would be in condition fit to receive the same treatment after such a term; and this land is now to be seen in the writer's neighbourhood, capable of feeding oxen of eighty to an hundred stone, fit for market as well as good sized wether sheep.

XI. OF RAPE.

No. CXII.

TIME OF SOWING.—*By Mr. Thomas Cussans, of Bedhampton, near Porstmouth.*

TEN years ago I was sent for to be a bailiff over 700 acres of land; there was a field of wet land, twenty-six acres, which was a good fallow and dunged, intended for wheat. The old labourers that worked on the farm about forty years told me, though it was a good fallow and well dunged, it was ten to one if there was a crop of wheat, for they knew the land to be false. I sowed it with rape-seed, and it came up very regularly. I turned in 100 sheep; it grew on them; in ten days after I put in another 100; it still grew on them. I put in 100 sheep more, which made 300; the sheep were all poor when they went into the rape: they were all fat after being there two months. It added to the sheep twelve shillings per head. The profit of the sheep was nearly as much as the field would sell for. The crop of wheat after the rape was very good. The soil of the field was very wet. It follows therefore, that on wet lands rape is a good substitute for turnips, if it be sown early in the spring, so that the land can be ploughed twice after it for wheat. It benefits the sheep, benefits the wheat crop, and the expence is very small. My father made a good fallow of seventeen acres wet land. Part of the field he sowed with rape; and as far as the rape went the wheat was good, and the other part was bad.

XII. OF CARROTS.

No. CXIII.

CARROTS.—*By Mr. Stephen Kershaw, of Driby, near Spilsby.*

THE country in general seem strangers to the utility of carrots in rich deep sandy soils, in which they delight. If new land is broken up it should be dug at least a foot deep, previously paring off the turf, and burying it in the trench after the loose earth is shovelled from the bottom. The best time for doing this is December or January. Lay it then in ridges that it may be ameliorated by the frosts, &c.; in March following dig it a second time; not so deep as to bring up the turf; then sow your seed, first rubbing it between your hands with some dry earth to prevent the grains from adhering together, which they are apt to do by forked hairs on their bodies. This should be done on a calm day, otherwise they might be blown into heaps; after which tread the ground, and rake it smooth. When the plants are come up, they should be hoed out at the distance of four or five inches, as it is not only necessary to set them singly, but this greatly promotes their growth. In about three weeks after you may hoe them a second time; and if you wish them to be large, they should be left eight or nine inches distant every way, and continue to keep them clean from weeds. The thinner they stand the larger they will grow. I remember once to have weighed three carrots, which together were more than ten pounds. In November, when the weather is dry, take them up, cut off their tops, and pile them horizontally in a groove, to what thickness you like; cover them well with earth, upon which lay straw, to prevent wet getting in. If your situation is not dry, lay them on the surface, and cover them as above directed, making a ditch round them to carry off the water. Carrots will stand most winters very well upon dry soils, and may be taken up as wanted, except

when frosts set in; during that time recourse must be had to the groove in which they are: if suffered to freeze they will rot, but not in the ground if dry, unless they get part eaten by hares, &c. which is sure to be the case if they have access to them; but even then they will not rot much. They are excellent food for horses and sheep, and only want to be in more general use to shew their intrinsic value. They are far superior to every other thing given to stock (corn excepted). This kind of land requires manure; let it be sowed that year with any thing else that is proper, as it would cause the carrots to be worm eaten, and shoot out lateral roots; but if eaten off with sheep, manure will not be necessary. Good ploughing will do after the first year of breaking up.

IX.

GRASSES.

No. CXIV.

THRESHED HAY SEEDS.—*By Allen Grebell, Esq. of Canterbury.*

THE crops intended for sheep should be fed on the land; if for cattle, they should be mowed and brought to the yard, or elsewhere, for soiling. I have succeeded with laying down with every corn crop. I have also found laying down with a mixture of cole-seed aad grasses, and stocking hard, to answer very well.

The best and cheapest method of procuring good seeds, and I have made many experiments at some considerable expence, having laid down 500 acres of land on different farms, and on many different soils, since the year 1794, is to save the crop of hay of a good permanent pasture about three weeks later than is usual for a hay crop. Thresh it in the field on a cloth; let it be well dressed, kept very thin and well aired till wanted to be sown. I would then recommend not less than a bushel per acre of these dressed seeds, well mixed with 5lbs. of broad clover, 8 or 10lbs. of Dutch clover, 8 or 10lbs. of trefoil, 5 or 6lbs. of rib-grass, and 5lbs. of chicory per acre, which, with good management, will very soon form a good pasture.

No. CXV.

COCKSFOOT.—*By Mr. John Richards.*

THE late Dr. Sibthorpe, Regius Professor of Botany in Oxford, laid a field at Southleigh with one sort of grass,* which was sown about Midsummer, and it is believed answered his most sanguine wishes; the particulars of which may be ascertained by application made to one of his principal servants now living there.

* Dactylis glomerata.

No. CXVI.

PARSLEY.—*By Mr. H. Hoyte.*

Sow down with twelve pounds of white Dutch clover, two pounds of red or broad clover, two ditto of parsley; and two pecks of rye-grass per acre; the parsley will stand two years, and acting as a diuretick, prevent the sheep from dying of red water, which seeds too luxuriant are apt to produce.

No. CXVII.

RAY AND YORKSHIRE WHITE.—*By the Rev. R. Duncan, of Kilmarnock.*

It has been observed of late, that there is an annual and a perennial rye-grass; and that the latter only should be sown; but the annual seed yields the greatest and most palatable crop of hay, and should be sown on those lighter soils which more readily tend to grass: at least a considerable proportion of it should be mixed with the perennial seed. The two kinds of seeds are easily distinguished by an attentive observer. The perennial is smaller and fairer in colour, than the annual; it is likewise much lighter. Good annual seed weighs from 21 to 24lbs. avoirdupois per bushel; but the perennial only from 16 to 18lbs.

When I first began farming, no distinction between these two seeds had ever been suspected. It may not be amiss to mention in what way, I think, they have come to be known and distinguished. No rye-grass totally disappears the first year; hence some persons, tempted by the high price of the seed, allowed what remained on the second year to come to full maturity; though it must be acknowledged in both cases, and especially in the last, to the essential injury of their pasture. Now, from the seed of the second year's crop, the perennial grass has gradually originated.

Its inferiority in point of substance seems to prove the supposition. In this way any farmer, by alloting a small portion of good soil for the purpose, may supply himself in what is said to be the perennial seed, without submitting to the imposition of an extravagant price; nay, he may insure or improve upon the certain durability of the rye-grass, by gathering what seed he can procure from the third or fourth years growth.

Some years ago natural or soft grass was much extolled for its abundant crop of hay and excellent pasture. The first trial I made of it, was also the last. I had the curiosity to lay down a field of five acres in the following manner: one fourth with rye-grass; another with soft-grass solely; one fourth with a mixture of both, the greater proportion being rye-grass; and another with the same mixture, the greater proportion being soft grass. The first and third were cut near three weeks before the second and fourth, because soft grass is at least that time later in coming to maturity. The crop of wheat, however, was nearly the same in weight; but the rye-grass division of the hay was always more greedily eaten by the horses and cattle, than the hay of the soft division; and in succeeding years the rye-grass pasture was always very bare before the cattle would touch the soft grass. In fact, the tufts of the latter appeared, for a time, like clusters of little isles in the sea. This experiment was soon known in the neighbourhood, and natural grass was accordingly discarded by its great favourers. *

No. CXVIII.

Yorkshire White.—*By Mr. Malcolm, Stockwell Place, Surrey.*

By no means whatever would I suffer the Yorkshire hay-seed, being the produce of the *bolcus lanatus*, to be sown; it is a soft woolly plant, as the name implies; grows in tufts, does not tiller out, and is in every respect a very inferior grass. I was some years ago recommended strongly by a seedsman to lay down a large extent of land, in front of a gentleman's house, with this seed, the ground for which

* It is proper only for sheep, and always to be close fed. *M. S. Note.*

I had previously levelled and otherwise modernized. The seed was fair and clean from other seeds, to which I added the usual quantity of clover and trefoil; It was laid down without barley or other grain. The season was favourable, the soil good and well prepared, and the seed vegetated to admiration: when the plants were sufficiently strong to admit of sheep, a flock of lambs were turned on, attended by a shepherd, and they depastured the whole ground until the month of November, having during that time fed it very close. As early in the spring as the season would permit, I had the ground very lightly bush-harrowed, to spread the worm casts, &c. and very heavily rolled in very dry weather. The clover soon began to spring and to tiller, the grass was sometime behind it, but when it begun to grow, it assumed a shape emblematical of its future figure. It was fed off this year by sheep indiscriminately, and therefore its form was not noticed, being kept so closely eaten down: nothing was suffered to depasture on it after the last week in October, and the same attention was paid to the bush-harrowing and rolling in the following spring, as in the preceding: it was again fed off; and in October following it was manured all over with a composition of rotten stable-yard dung, scrapings of the road, and the rubbish of some old buildings, all well mixed together in the course of the season; the quantity laid on each acre was not noticed, because I made a point of attending to the variations of the soil from depth to shallowness, and quality of soil to thinness or fulness of crop; my rule being invariably to dress thin, but often. As soon as the dung or manure was spread, I had it well bush-harrowed, and every stone or bone, &c. very carefully picked off, and the same carted away to mend the roads in the grounds. Early in the following spring I applied a lighter bush-harrow and heavy roller, the land was shut up for hay, and every prospect favourable; the crop was mown, and so abundant and regular, that it yielded when cut out and bound into trusses above two load to the acre; but it proved to be of such a coarse, long, and woolly nature, that such of it as was sold in London fetched an inferior price, although it was got up in the very best manner, without rain, and had sufficiently heated to give it a fine flavour. As soon as it began to grow it was fed off with sheep; and finding by the character of the hay, and the encreasing size of the plant out of ground, that it would not answer to be continued, it was determined to break it up again.*

* Proper only for sheep feeding, and answered so fed, in this trial. *M. S. Note.*

No. CXIX.

HOLCUS MOLLIS.—*By the Rev. Dr. Graham, of Aberfoil, near Stirling.*

To this species of grass, I would wish particularly to call the attention of my countrymen. The *holcus mollis*, in favourable situations, has a broad succulent leaf; the flower or seed spike is large, and abounds with nutritious seeds. The whole plant spreads, and forms horizontal stools of sometimes fourteen or eighteen inches in diameter. It is particularly grateful to cattle; and from the abundance of its seeds, and its disposition to multiply by shoots, it seems peculiarly fitted for covering the ground expeditiously, after having been broken up in tillage. In our sandy and loamy fields in Scotland, it forms the great bulk of the grass crop which appears the second year, after having sowed clover and annual rye-grass.

No. CXX.

RAY AND RIB GRASS AND CLOVERS.*

With good management, land will prove to be not at all exhausted by breaking up, but for three succeeding years will keep more stock than grass of any age; on some descriptions of soils however a great falling off will take place, and very little grass will be produced for several years.

I experienced this in laying a field, consisting of one hundred acres, into grass. The soil differed very much in this field; one part was a clay bottom with a heavy surface; another, the same bottom under a black loam; and a third part was a clay bottom under a kind of gravel. I fallowed the field, laid lime and dung upon it, and sowed it with barley and grass seeds, about two bushels of the former

* No name.

to an acre, and 16lbs. of seeds, *viz.* 8lbs. of white, 4lbs. of red, 2lbs. of rib seed-grass, with 2lbs. hop or yellow clover, with half a bushel of rye-grass. For the first three years, the quantity of grass produced was most wonderful; but after that an almost total failure took place, which continued for no less than seven years, till the natural grass made its appearance.

In other fields I have found, that although the failure after the third year was not so great, yet they seldom paid well till after a lapse of some years, when the natural grass sprung up.

No. CXXI.

Clovers.—*By Mr. Joseph Atkinson, Swarland, Northumberland.*

Quantity and kinds of grass seeds per acre. 18lbs. of white clover, *trifolium repens;* 10lbs. of yellow clover or common trefoil, *medicago lupulina;* five bushels of ray grass, *lolium perenne;* and five bushels mixed, finer grasses, if such can be obtained, carefully separated from and entirely clear of rib-grass, *plantago lanceolata,* which it truly astonishes me that any man should attempt to cultivate, and which I can only consider as a very pernicious weed of the most difficult extirpation, and most to be dreaded in the use of the trash called hay-seeds. This however it were folly to reject, and futile to exclaim against, until selections of the finer grasses shall have been made, and separately cultivated; or unless we are to content ourselves with ray-grass alone; for it is the only one, to my knowledge, that in any quantity can be separately procured.

The practice of my vicinity is to sow a few pounds of clover, *trifolium pratense,* and a few bushels of hay seeds, mostly consisting of rib-grass. This they mow the first year; and indeed if grass is the object, the sooner means are taken to extirpate these plants the better; for so long as they remain, they only serve to defeat the bounteous hand of Providence; which while men neglect to cultivate them, secretes the seeds of the finer grasses in the soil, and wafts them on the winds of Heaven. But it is evident, that the plants above recommended cannot be cut the first or

second year, without receiving irreparable injury; the *trifolium repens*, in particular; for its nature is when pastured upon to recline upon the ground, and multiply itself the more it is cropt and trod upon, but if obliged to rear its stalk in the struggle for existence with the more upright plants, and then cut off, it "falls to rise no more." To break and chop the tender sward by the feet of cattle, being also evidently improvident and injurious, sheep only should at first depasture, and cattle ought to be excluded until the sward has attained closeness and strength. I shall not hesitate therefore to assert, that on no soil or situation whatever, ought grasses, intended for perennial lays, to be cut either the first or second year for a a crop; but it may be useful in many instances to sweep over the seed stalks and weeds with the sithe.

No. CXXII.

Carraway.—*By Mr. Thomas Chatterton, of Waplington, near Pocklington.*

The carraway is a well known seed, sold by the druggists; but where they get it is unknown to the writer, save that he knows it grows wild in the fields about Hull. The poor people there gather it for sale, yet not in any great quantities: it is easily propagated in almost any soil. A neighbour, who had lived some years in Hull having observed it, gathered two or three pounds of it, and when he left Hull brought it with him, and some years after having a piece of land to be sown with grass-seeds, he threw his carraway seeds in amongst the rest. In a year or two afterwards he related what he had done, and that the plants flourished well; that all kinds of cattle ate them, and at the same time invited the writer to see them. The land upon which they were sown was a chalky gravel, mixed with a sandy soil, about four acres. Though so small a quantity of seed was sown, when they were two years old, ten days or a fortnight before any other grass appeared, they resembled a field of fine carrots. The writer set a few of these plants in his garden, and upon observing the following spring they were the first plants that made their appearance, either in the garden or the field, he thought they must be valuable for

the support of sheep in spring, as well as great improvers of land, their roots resembling the carrot, except that they branch out into several thongs. They shoot deep into the earth, and consequently gather their support considerably below the surface; they were of great substance, and good to eat as carrots, as is said in an old herbal wherein the carraway is highly spoken of as a cordial herb. The writer, however, principally considered its use as a field plant, and was of opinion if it would flourish in fields, it would not only be valuable (he had almost said invaluable), as feed for cattle, particularly for sheep, but also greatly useful as a manure whenever the land came under the plough, the root being large and of a rich nature. If it is at all valuable its perenniety adds to its value. It will be seven years next spring since that seed was sown on the chalky gravel, and it seems to maintain its vigour, save that last summer it did not make any great show. Fourteen pounds of carraway sowed in the year 1797, upon thirteen acres of sand land, produced more plants than could have been expected from such a quantity of seed, provided every seed grew, which gives it a preference to many other seeds in that respect. Sheep were put into the piece the 6th of March 1798, the spring after sowing. The plants were not by that time come to their size, nor could they be considered as yielding very much feed, but they then were six or eight inches high, and were very serviceable to the new lambed ewes. In the spring 1799, the carraway made a vigorous shoot, and proved particularly serviceable for early food between turnips and grass; but last spring it made only a weak shoot, and never appeared much in summer; and though the field was mowed, very little of it made a seed shoot. The reason is not easy to be assigned, why the carraway should be less inclined to make its appearance than any other plant, though there was a shortness in all grass crops, which might in part be owing to the absence of the grasses which constitute the sward of meadows, &c. yet none of the common grasses seemed so deficient as the carraway. That something in the season however was the cause, and nothing from the age of the plants, is pretty evident, as those of one, two, three, and six years, were equally weak. Not any of whatever age which the year before were vigorous, made such an appearance in 1800. Care will be taken in future to make every useful remark on this plant, and should the Honourable Board think it worth enquiry after, all information of its excellencies or defects will be faithfully transmitted.

The writer has observed, that when a pasture is very bare wherein the carraway

grows, sheep are apt to scoop out the heart of the root; but whether it either kills or injures the root, he cannot say; certain he is, this was not the cause of the failure mentioned above. As it makes an early entrance in spring, so it retires early in summer; little of it is to be seen after Midsummer till the spring following. The strong warp land about Hull appearing to be its favourite situation, the writer is of opinion all strong soils would agree with it; and that from its perenniety, it might be the most useful grass that can be sown upon such strong soils as are with difficulty swarded; but he has not had an opportunity of trying the experiment.

No. CXXIII.

SAINFOIN.—*By Mr. John Johnston, of Welton, near South Cave, Yorkshire.*

I HAD a piece of old tillage in seeds, on a hill side, a south-east aspect, and a chalk bottom, on the York Wolds. It was ploughed up in June, and fallowed through the summer. In the following spring it was sown with about five bushels of sainfoin-seed on an acre, with barley. After the first year, it cut on an average one ton and a half per acre, and this for eight or more succeeding years, when it was injured by being eaten too near with sheep. I then broke it up again, and after one rotation of cropping, it was sown as before with sainfoin on a turnip fallow. This last summer, being the second of its cropping, it cut two tons on an acre.

I have had several other pieces of sainfoin, some of which have succeeded well, but this was the greatest improvement I ever had on this kind of ground. I have sometimes sown two pounds of trefoil or red clover on an acre with the sainfoin, which has been useful the first crop, but injurious to the sainfoin ever afterwards. Sainfoin is proper for mowing, to be cut in its fullest bloom; the fogg or eatage may be pastured with sheep for a few weeks after Michaelmas, but at no other time, and then it should not be eaten too near.

No. CXXIV.

Dormant Seeds.—*By Mr. Morris Birkbeck, of Warnborough, near Guildford.*

Old grass land is universally distinguishable from old arable, by a stratum covering the original soil, composed of living and dead vegetable fibres, the remains of decayed vegetables, and a portion of earth intermixed, varying in quantity according to the nature of the soil and of the plants which form the turf; and containing abundance of the seeds of those plants, in a dormant state, but always ready to vegetate when placed in circumstances favourable for that purpose.

Of the existence of these seeds, where they have not been destroyed by abortive vegetation, as in old arable land, there can be no doubt, unless we admit the equivocal or spontaneous production of plants; but, to establish the fact by direct proof, I caused two portions of turf, one from a loamy soil, the other from chalky down, to be carefully washed; and though it was with difficulty the minute seeds could be extricated from the mud and small fibres, a variety of species were discovered, in complete preservation.

Until agriculturists shall have at their command the seeds of the valuable pasture grasses, as they have at present those of clover, rye-grass, &c. they must rely, for the reproduction of turf, on those which are locked up in the vegetable stratum of all old grass land.

A field of old turf of fifteen acres, strong loam, was broken up by the plough; and, after a good summer, laid down again the next spring with rye-grass and trefoil: these by the third year were nearly extinct, and the natural grasses had re-established themselves completely.

Eight acres, part of an adjoining field of old tillage, similar as to soil, was laid down without seeds. This acquired a turf as speedily as the former; but it was principally indebted to a single species, the *agrostis stolonifera*, or black couch; a circumstance which I expected and wished for; the habits of this plant being singularly adapted for water-meadow, which was my object. Having relied solely on

the *agrostis stolonifera* for the formation of a turf for the purpose of irrigation, I think it right to add, that the effect has exceeded my most sanguine expectations: where the water has had its due effect, it would be difficult to distinguish it from old meadow of very superior quality, though it is only a year and a half since it was laid down.

I have also made a similar experiment, the last spring, on a field of five acres, which was full of the *ranunculus repens.* Ten pounds per acre of perennial clover, and one quarter of hay-loft seeds, containing abundance of Dutch clover, were sown with barley. It is now under water, and the *ranunculus repens* promises to form the basis of an excellent turf. Arable lands are frequently foul with the roots of this plant, and when such are under preparation for grass, pains are taken to destroy it, which is injudicious; for, though a noxious weed among corn, it is of great value in pasture.

Perhaps there is no way in which the Board could more effectually promote the interest of agriculture, than by a proper encouragement of the cultivation of natural grasses and other plants, which compose the herbage of the best old pastures.

We are already in possession of the seeds of several plants of great value, in the formation of perennial turf, *viz.* rye-grass, *lolium perenne*; perennial clover or marsh grass, *trifolium pratense*; Dutch clover, *trifolium repens*; rib-grass, *plantago lanceolata*; meadow soft grass, *holcus lanatus.* If to these were added meadow fox-tail, *alopecurus pratensis*; meadow fescue, *festuca pratensis*; and a few more species whose particular habits have not been as yet sufficiently studied, we might, by a liberal use of a suitable mixture of these seeds, command valuable grass land in many vale countries; which have been injudiciously continued under a course of aration, to the impoverishment of the occupiers, and the public loss.

No. CXXV.

SEPARATED GRASSES.—*By the Rev. George Swayne, Pucklechurch, near Bristol.*

FOR lands intended to pasture the larger kinds of cattle, or for hay, a proper mixture of grass-seeds would be to an acre: six pecks of meadow-foxtail, *alopecurus pratensis*; two pecks of ray-grass, not the ray-grass of the shops, but either Pacey's ray-grass, or ray-grass lately from seed, collected in old grass lays, *lolium perenne*; two pecks of meadow fescue, *fescuta pratensis*; one peck of tall oat, *avena elatior*; half a peck of rough cocksfoot, *dactylis glomerata*; half a peck of hard fescue, *fescuta duriuscula*; two pounds of crested dogstail, *cynosurus-cristatus*; four pounds of cow-grass, cow-clover, or honeysuckle trefoil, *trifolium pratense*; the native variety.

For upland soils, intended chiefly for sheep feed, the composition might properly be: three pecks of ray-grass; two pecks of yellow oat, *avena flavescens*; one peck of hard fescue; half a peck of rough cocksfoot; four pounds of crested dogstail;* three pounds of white clover, *trifolium repens*.

For meadows subject to be flooded, or lands intended for irrigation, the following are recommended: three bushels of meadow foxtail; one bushel of meadow barley, *bordeum pratense*; two pecks of meadow-fescue; three pounds of cow-grass; four pounds of common meadow-grass, *poa trivialis*.

N. B. The dogstail and cow-grass, or the dogstail and white clover, should be mixed together, and sown with the fingers and thumb in the manner of turnip seed. The larger seeds should be mixed together, and sown by handfulls from a seed lip. The common meadow grass-seeds should be mixed and rubbed well with a quantity of saw-dust, to prevent it from sticking together and falling in lumps. The ques-

* The leaves of the dogs-tailgrass do not grow so high as many other grasses, but they tend greatly to make the turf close and thick. On Lansdown near Bath, famed for fat and fine flavoured mutton, there is a great proportion of dogstail-grass.

tion will instantly be proposed. Where are the seeds here recommended to be procured? It is answered. Any person may with a little trouble and a small degree of forecast, soon supply himself with the seeds required. Let him but collect from the fields in the summer of that year when he begins to break up his grass land, a few ounces (in proportion to the quantity of land to be laid down, an ounce or two for an acre) of the seed he requires, and sow them in July or August in a small plat of ground appropriated for that purpose, and the next summer save the seed produced from that plat, and sow the whole of the produce on a larger spot of ground; at the same season; and preserve the seeds arising from both sowings the ensuing summer, and he will find himself possessed of a sufficient quantity of seed to lay down his field with, by the time he has occasion for them. *

Failure of Seeds.

Should the grass-seeds fail in any particular spots, it will be proper to hoe the ground over in such places, and to scatter a few seeds of the same sorts with which the field was first sown, and rake them in, any time in the summer after the corn is carried off, but not till the weather is inclined to rain. Should the whole or the greater part chance to fail, it would be adviseable to skim over the barley or oat stubble as soon as possible, to harrow it well, to rake up, burn the stubble, &c. scatter the ashes, and resow the whole field as soon as there is a prospect of wet weather. This will often succeed as well or better than the spring sowing.

No. CXXVI.

Quantity.—*By Mr. W. Wright, of Ranby, near Retford.*

There has been great error in the general practice of seeding land, the quantity of small seeds sown not having been sufficient; twelve or fourteen pounds of clovers per acre have been the usual average allowance, which I believe ought to be

* For the best method sowing and managing these seeds, see Annals of Agriculture, Vol. XII. p. 358.

doubled. I have seen in the farms of several of my friends, pieces of seeds sown with ten pounds of red clover, ten of white, and ten of trefoil, making in the whole thirty pounds of small seeds, and about three pecks of rye-grass per acre; finer herbage I never saw, and am now clearly convinced of my error in having sown a much smaller quantity.

No. CXXVII.

SEEDS.—*By Mr. George Aikin, of Hardwicke-hill Farm, near Bedford.*

LAY down the land with two bushels of smooth stalk meadow-grass, one peck of meadow-fescue, and two bushels of meadow fox-tail, with ten pounds of white Dutch clover, and four pounds of trefoil.

X.

FEEDING OR MOWING.

No. CXXVIII.

By Mr. Henry Hoyte.

"WHETHER it be best to mow or feed the grass in the first year after laying down, where land is laid down with corn and intended to continue in pasturage?" —In my opinion, it should always in the first instance be eaten in preference to mowing; and great care should be taken in the stocking of young seeds, and the management of all lands just laid down. In the first season, you should confine yourself to sheep, except in the middle of the summer, when a few light young cattle may be put in to eat off the superfluous grass; and in the winter following, if any stock at all be depastured, it must be sheep, and they very lightly laid on. Every attention should be paid to this principle, till such time as your sward is become sufficiently thick and matted, to admit of a greater proportion of stock, without doing any injury.

No. CXXIX.

By Mr. George Aikin, of Hardwicke-hill Farm, Bedford.

THE land should not be stocked the succeeding year till about the middle of April, or May-day, and then with sheep, ewes, and lambs. Towards the end of June or beginning of July much of the grass and clovers will have run to seed; then brush-harrow it well, so as completely to scatter the seeds; and run over it a good coat of earth or of compost, to be also brush-harrowed and rolled. It may be

thinly stocked for the rest of the season, and in the spring it will be found a fine luxuriant turf, little inferior to any old sward; and, with proper care and attention, will be found exceedingly productive and continually improving. It will not be proper to stock the first year with cattle, as they would be apt to tread it up; nor with horses, for the additional reason, that they eat so near the ground as to tear up the young grass by the roots. Indeed it is always best to keep horses at home on clover or tares. It is true, that sheep also are in some degree liable to the latter objection, but it is obviated by letting the grass get a good head before it be stocked, as it will do by the beginning of April. If the spring is tolerably favourable, I am of opinion that very little grass land, and certainly none recently laid down, ought to be mowed; but where circumstances will admit, the farmer should depend on his clover or tares for hay.

No. CXXX.

By Mr. John Kiddle, of Marsham, near Aylesham.

I HAVE made different trials on this subject, which have determined in favour of mowing the grasses the first year, though I must own, contrary to the opinion which I had previously formed. I had an opportunity of having a fair experiment in the case, on two inclosures, which were laid down with grasses in the same year with a similarity of soil, and an equal quantity and quality of seed on an acre sown on them. The one was fed the first year, the other mown; the grasses of the latter the succeeding year, yielded considerably more feed, and the bottom thickened, and seemed to grow with more strengh than the other, and kept the lead in every succeeding year. The only reason I can assign for the grasses doing better, and shooting the succeeding year more strongly, is, that the young and tender grasses, continuing during the spring and summer months unmolested, their roots increase in growth and acquire more strength, than when the blade is continually cropped by cattle during these months. I would not be understood as stating, that I think it proper to repeat the mowing a second time, in the same year, but I would have

no cattle turned on the land to feed the after-growth till the winter months, or latter parts of autumn at soonest; by these means the bottom of the land is more closely covered, and kept increasing more than when fed at an earlier period.

No. CXXXI.

By Mr. W. Jones, of Fox-down House, Wellington.

THERE are some advocates for mowing grass the first year after laying down; and such persons must have a view to a present profit, rather than to a future improvement. I am decidedly of opinion however, from experience, that feeding it off is the best method, not only to improve the land, but to perpetuate these grasses also, that it may be restored as soon as possible to its pristine state, which may be insured, and probably a better, if the land was not originally laid down well by feeding it off first with sheep, before it has got too high, afterwards with horned cattle and horses to eat it down bare. Then let it remain till the white Dutch clover has its seeds formed, which the sheep and other cattle, by continually going over it, beat out and tread into the ground for a future crop. Another reason for feeding it off is, that the white Dutch clover, in particular, running on the ground like a strawberry, and taking root at every joint, is sure to be increased more by being pressed to the ground by the feet of the cattle, than when cut off erect by the sithe.

XI.

LIVE STOCK.

No. CXXXII.

Cows.—*By Mr. George Cathery, of Alresford, Hants.*

THE reduction in the number of cows, and increase in that of horses, must be apparent to every common observer. Nothing will give so much relief in the difficulties of this country with respect to grain, as increasing the number of cows. Milk used with rice and bread by children, would save half the consumption of each of those articles. Nothing can be substituted so quickly or so cheap. Each cow so used, would save one load of wheat per annum.

If one-fourth of the land which at present is sown with corn, was in grass for the purpose of feeding stock, it would be of the greatest benefit, as the other three-fourths would be better manured, more easily sown, and would produce as much for consumption as the whole now does. The failure of crops in a great measure may be attributed to land being sown out of condition, and without manure; or if manured, at a greater expence than it is able to repay. Were I induced to break up any grass it should be a good dry meadow upon a loam, which will produce more corn than any other soil, and not lose above one-fourth in value, supposing it to be worth at present 40*s*. per acre, and when ploughed only 30*s*. per acre. I will state the manner of cropping it for four years, and of then laying it again into grass. I shall state also what it would pay in that time, by keeping cows on, to supply the poor with milk, which supply would be immediate, and might be given out in every parish in lieu of money.

Twenty Acres of Meadow, value 40s. per Acre.

First Year's Crop. Potatoes.

20 Acres; ten tons per acre; £3. per ton. - - -		£.600 0 0
Expences.		
Rent at 40s. per acre - - -	£40 0 0	
Tythe, at 10s. per acre composition - -	10 0 0	
Poor, highway, and church rate, at 7s. in the pound	14 0 0	
Ploughing four times and harrowing, at 12s. 6d. per acre	50 0 0	
Flat hoeing and earthing up, at 8s. per acre. - -	8 0 0	
Seed 20 bushels per acre, at 2s. - - -	40 0 0	
Digging up and housing 200 ton of potatoes at 5s. per ton	50 0 0	
	212 0 0	

Second Year's Crop. Wheat.

20 Acres, three quarters per acre, at £4. per quarter - -		£.240 0 0
Expences.		
Rent, at 40s. per acre - - - -	£40 0 0	
Tythe, at 10s. per acre. - - -	10 0 0	
Poor, highway, and church rates, at 7s. in the pound	14 0 0	
Two ploughings and harrowings, at 12s. 6d. -	25 0 0	
Seed wheat three bushels per acre, at 10s. - -	30 0 0	
Harvesting, reaping, carting, &c. 15s. - -	15 0 0	
Threshing sixty quarters, at 4s. per quarter - -	12 0 0	
	146 0 0	

Third Year's Crop. Turnips.

20 Acres turnips fed on ground, at £3. per acre. - -		£60 0 0
Expences.		
Rent, at 40s. per acre - - -	£40 0 0	
Tythe, at 10s. per acre - - -	10 0 0	
Poor, highway, and church rate, at 7s. in the pound.	14 0 0	
Ploughing four times and harrowing, at 12s. 6d. -	50 0 0	
Seed and hoeing, at 7s. - - -	7 0 0	
	121 0 0	

Fourth Year's Crop. Wheat.

20 Acres, three quarters per acre, at £4. per quarter - - £240. 0 0

Expences.

Rent, 40s. per acre. - - -	40 0 0	
Tythe, at 10s. - - - -	10 0 0	
Poor, highway, and church rate, at 7s. in the pound	14 0 0	
Ploughing once and harrowing, at 5s. - -	15 0 0	
Seed, at three bushels per acre, at 10s. - -	30 0 0	
Harvesting, at 15s. per acre. - - -	15 0 0	
Threshing sixty quarters, at 4s. - -	12 0 0	
Seed sown in the wheat - - -	10 0 0	
	£146 0 0	

The land being reduced in value 10s. per. acre, or £10. per annum, at thirty years purchase is £300; from this time the rent must be reckoned at 30s. per acre; the proprietor to pay for the seed sown in the wheat, as it is intended the land to lay again for a meadow.

Dr.		*Contra.*	*Cr.*
To First year's expences	£212	By First year's crop -	£600
Second ditto - -	146	Second ditto - -	240
Third dittto - -	121	Third ditto - -	60
Fourth ditto - -	146	Fourth ditto - -	240
Land being reduced £10. per annum, deduct	300		1140
Expences	925		925
		Profit	215

The land should be ploughed the first time when broken up about November, six inches deep, with a wide furrow, in order to turn the turf over as flat as possible, that it may rot quickly. When it is laid again into grass, which will be the fourth year, sow 10lbs. of Dutch clover per acre, and feed it the first year, by which

means it will continue to drop seed, which will make it very thick on the ground, and it will come to a turf more quickly by being sown in wheat, than any other way. It will not be worth more than 30*s*. per acre for twenty years.

Meadow land worth 40*s*. per acre, will keep a cow on two acres and a half; each cow will give two gallons of milk for twelve months out of thirteen, allowing one month to be dry. I have stated the crop of wheat £20. per load, the milk at 8*d*. per gallon: not wishing to state it too high, I have in the statement made a considerable abatement from it.

Eight cows to consume the produce of twenty acres of meadow of the annual value of 40*s*. per acre,

Sixteen gallons of milk per day at 8*d*. is 10*s*. 8*d*.; £3. 14*s*. 8*d*. per week for 48 weeks, is £179. 4*s*. or £22. 8*s*. per annum each; not wishing to charge too high, will state it at £20. each - - - - £.160

4

Produce of 8 cows 4 years £.640

Expences.

Rent - - -	£.40 0	
Tythe - - - -	10 0	Expences of 8 cows 4 years - 338
Poor rate - - -	14 0	
Mowing six acres, and making hay, &c. - - -	4 10	Profit on cows - - - 302
Milking, 40*s*. per cow -	16 0	Profit on ploughing - - 215
	£. 84 10	In favour of cows, and the land being in an improved state £.87
	4	
	£. 338 0	

No. CXXXIII.

On Daries.—*By Mr. Thomas Best, of Hazelbury, Crewkerne.*

I do not think it would answer the purpose of any farmer to break up good old pasture land; I mean such as is worth from 30*s.* to 40*s.* per acre. Labourers in this neighbourhood are very scarce and dear, and if more land be converted into tillage, more men of course would be wanted to manage it, and there would be a great difficulty in obtaining them. Whilst the land is continued in pasture, but little expence attends it. The farmer would therefore bring upon himself a deal more trouble, without much profit. It is customary in the counties of Somerset and Dorset, for the farmer that occupies a large farm, to let his milch cows to a man called a dairy-man, from Candlemas to Christmas. During this time, the farmer has nothing to do with the lands on which those cows depasture. Some allow twenty acres of land, others perhaps a little more, of the above description, to summer fifteen or sixteen cows on, with one acre of aftermath to each cow in addition. Cows at this time are let from £10. to £11. per cow. From this method a profit arises, in my opinion, equal to a crop of corn.

No. CXXXIV.

On Cake Feeding.—*By Mr. Henry Hoyte.*

As the turnip crop may justly be esteemed the principal dependence, it behoves us to apply every exertion to produce it, where it can be procured. Oil cakes, or the manure arising from them, are an excellent preparation for all poor soils; it is universally practised on the heaths near Lincoln, as well as on the Wolds in that county, where the farmers make a point of cake-feeding their beasts in the winter, to enrich

their manure for the succeeding turnip crop. So highly is this manure held in estimation, that Mr. Moody, during the time he held a farm at Riseing, near Lincoln, consumed all his straw arising from his corn, by beasts purchased three parts fat, giving them straw and cake only. Mr. Rains, of Temple Brewer, near Lincoln, I believe was the first person that adopted this valuable and admirable mode of practice; and so well was he convinced of the advantages arising from cake manure, that he not only fed his beasts, but likewise his sheep intended for market, on cakes, which were given them in troughs during the time they were at turnips, which amply repaid him in the succeeding crops.

No. CXXXV.

On Soiling.—*By the Rev. Robert Duncan, Minister of Kilmarnock.*

I always keep my work horses on red clover through the summer, and they are as healthy and fit for labour as any of their neighbours that are turned out into the pasture. Last year I cut the clover three times, and thirty falls or perches yielded as much as one horse was able to consume. I have frequently intended to try a crop of goose-grass for hay, upon some piece of ground which was not to remain in pasture; but I have always met with some avocation at the time when the seed of this grass could be procured. I am surprised that goose-grass has been so long neglected, nay despised. It is considered as a weed among rye-grass, though I have observed that the horses are not of the same opinion. Its hay is most substantial; and were it allowed to come to maturity, its seed would be little inferior in weight to oats, and would probably be an excellent substitute for them in the food of horses.

He who can procure 200 carts of dung, from the same extent of ground where 100 only were formerly produced, certainly possesses a double power of improving it. A great reserve of straw is necessary for litter to horses when living on red clover. When the straw fails, some bed their horses with dried rushes; but rushes contribute very little to the manufacture of dung. When fern, or as it is here called

the "braken," can be gotten, I would recommend it as next to straw for the littering of horses or black cattle, and as the best of all land vegetables for the dunghill. The value of its ashes is well known to the Highlanders of Scotland for bleaching their linen. More benefit would be received from the dung of cattle grazing on pasture land, were the fresh dung carefully spread with a shovel, once at least every week. The dung of horses and cows should be mixed together in the dunghill, and care taken to keep ashes of burnt coals in a separate place. The utmost attention is requisite to prevent the seed of weeds being thrown into the dunghill; for this purpose my farmers are instructed not only to separate the grain from the chaff, but likewise, by means of a wire sieve or netting, over which the grain passes, to separate it from small seeds. These are carefully buried below the reach of any plough.

No. CXXXVI.

Soiling.—*By T. J. Rawson, Esq. of Cardrington, near Athy.*

I very much approve of, and have long practised, the feeding of horses and spring cattle, in summer, upon clover; I have found that an acre of clover, cut and carried to the cattle and horses in their hovels and stalls, will maintain double the quantity of stock to an acre pastured; besides the very great quantity of manure produced by this mode of feeding, which secures almost to a certainty the turnip crop.

No. CXXXVII.

On Horse Feeding.—*By Mr. W. West, of Musleliffe Farm, near Christ Church, Hants.*

In the months of October, November, and December, 1798, I gave to my working horses upwards of 700 bushels of haws, or white-thorn berries, with chopped hay and straw, in lieu of corn. Two bushels of berries were equal to one bushel of oats; they were got by old people and children at *7d.* per bushel. All the horses were fond of them, and performed their work as well as with their usual quantity of corn. My neighbours used them with the same success as long as there were any to be gotten.

No. CXXXVIII.

Hay and Straw Soup.—*By Mr. John Mackenzie, of Glasgow.*

The increase of manure is more than an indemnification for the expence of feeding in the house, and I am convinced that cabbages, turnips, carrots, and potatoes, will go a great deal further boiled with water or steam, in the feeding all sorts of cattle, than used raw; so will hay and straw; and I do not know but from these two last, wholesome pleasant fermented liquor may be procured.

XII.

RENT.

No. CXXXIX.

INCREASE OF RENT.—*By Mr. William Cullingworth, of Daventry.*

"THE principle on which an encrease of rent ought to be estimated, when permission is given to break up old pasture now under lease."

I have known within these five years past, a double rent given for leave to plough up an old pasture for cropping for three years.

It appears then to me, that a statement of the expences and profits upon arable and pasture lands, should be severally made out, to ascertain by how much the balance of profit of the one exceeds that of the other. I shall therefore state them upon a probable calculation.

EXPENCES.

	1. Wheat.	2. Wheat.	3. Pease.	4. Wheat.	5. Beans.	6. Sp. Wheat.	7. Total.
	l. *s.* *d.*	*l.* *s.* *d.*	*l.* *s.* *d.*	*l.* *s.* *d.*	*l.* *s.* *d.*	*l.* *s.* *d.*	*l.* *s.* *d.*
Rent and Taxes	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	10 10 0
Seed	0 18 0	0 16 0	0 18 0	0 16 0	0 10 0	0 14 0	4 12 0
Ploughing	0 12 0	0 12 0	0 12 0	0 12 0	0 12 0	1 4 0	4 4 0
Harrowing	0 2 6	0 2 6	0 2 0	0 2 6	0 2 6	0 2 6	0 14 6
Manure and Carting	0 0 0	0 0 0	2 10 0	0 0 0	2 10 0	0 0 0	5 0 0
Frightening Birds	0 2 0	0 2 0	0 2 0	0 2 0	0 2 0	0 2 0	0 12 0
Weeding and Hoeing	0 1 6	0 1 6	0 1 6	0 1 6	0 3 6	0 1 6	0 11 0
Reaping and Mowing	0 6 0	0 10 6	0 6 0	0 10 6	0 6 0	0 10 6	2 9 6
Cocking and Raking	0 2 0	0 0 0	0 2 0	0 0 0	0 1 0	0 0 0	0 5 0
Carrying and Stacking	0 4 0	0 4 0	0 4 0	0 4 0	0 2 0	0 4 0	1 2 0
Thatching	0 1 0	0 1 0	0 1 0	0 1 0	0 1 0	0 1 0	0 6 0
Threshing and Winnowing	0 6 0	0 9 0	0 6 0	0 9 0	0 7 6	0 9 0	2 6 6
Carrying to Market	0 4 0	0 4 0	0 4 0	0 4 0	0 4 0	0 4 0	1 4 0
Contingencies	0 4 0	0 4 0	0 4 0	0 4 0	0 4 0	0 4 0	1 4 0
	4 18 0	5 1 6	7 7 6	5 1 6	7 0 6	5 11 6	35 0 6

Produce.

1. Pease, three quarters, at 48*s.*	£.	7	4	0
2. Lammas wheat, three quarters and a half, at 52*s.*		9	2	0
3. Pease, three quarters, at 48*s.*		7	4	0
4. Lammas wheat, three quarters and a half, at 52*s.*		9	2	0
5. Beans and turnips; five quarters of beans, at 30*s.*; turnips, 30*s.*		9	0	0
6. Spring wheat, three quarters, at 48*s.*		7	4	0
Straw		5	4	0
		54	0	0

Tillage produce	£. 54	0	0
Ditto expences	35	0	6

6)18 19 6 (= £3. 3*s.* 3*d.* profit per acre for the farmer.

Grazing Expences.

Rent and Taxes per acre	£.	1	15	0
Labour - ditto		0	10	0
		2	5	0

Grazing Profit.

A bullock and a half to three acres, at £5. per head	£.	7	10	0
Three sheep upon ditto, at 25*s.* per head		3	15	0
		11	5	0
Grazing produce of three acres	£.	11	5	0
Ditto expences of ditto		6	15	0
		4	10	0
Profit per acre to the grazier		1	10	0
Then say grazing profit per acre		1	10	0
To which add for grass seeds		1	0	0
The additional rent to make up the sum as per contra, will be		0	13	3
	£	3	3	3

XIII.

GRAZING AND TILLAGE COMPARED.

No. CXL.

By Mr. R. Brown, of Markle, Haddington.

THE first and chief advantage resulting from breaking up certain portions of the grass land, would be, that the public would thereby be furnished with an ample supply of the necessaries of life. It is computed, by people versed in such Inquiries, that good pasture land throws off about twelve stone of beef per acre per annum, above the weight of the animal or animals, when they are laid upon the grass, which, upon the supposition that a healthy person requires two pound* weight per day for his support, would thus be consumed in eighty four days. If this land be converted to tillage, the number of mouths that may be fed from its produce, is astonishingly increased. Suppose the crops to average six quarters per acre, which is not an excessive computation, when one half of them will probably be barley and oats, and that four bushels for seed, and six bushels per acre for house corn, will be used, then the quantity remaining for the food of the people is four quarters six bushels per acre, which at an average weight of four hundred pounds per quarter, gives nineteen hundred pounds of bread corn, or what may be used for the support of the people. If we estimate, that one-fourth part of this produce will go for waste, pollard, or seed in the manufacture of the grain into meal (which as one of the crops is oats, will not be far from the truth), then there will remain 1425lbs. of meal or flour to be manufactured into bread, or used in other ways; this at 3lbs. a head per day, would supply 475 day's consumption of an individual, instead of 84 day's support afforded by the land when in grass. If the comparison were carried to potatoes and other articles of the leguminous tribe, the contrast would be still more striking.

* On what data is this supposition founded? MS. Note.

XIV.

ON VARIOUS SUBJECTS.

No. CXLI.

NATIONAL PRODUCE.—*By the Rev. Dr. Robertson, of Granton, near Edinburgh.*

FROM Carey's very elegant map of England and Wales, published about five years, and which after travelling by it above 700 miles through the country, I have found astonishingly correct, it appears that from Berwick SE. to the South Foreland is 330 miles in a strait line; from the South Foreland W. to the Lands-end is 310 miles, and from the Lands-end to Berwick N. by E. is 406. The area contained in this triangle amounts therefore to 50,375.89 miles, from which deducting different portions of sea contained within it equal to 5375½ square miles, and adding different portions of projecting land, amounting to 10,924½ miles; the surface of England and Wales would thus be 55,924 square miles. This amount, having no other *data* before me to calculate from, I shall, for the present, presume to be accurate.

Now from all that I can learn, on perusing the late agricultural surveys of England, and from what I have in person observed in traversing, at different times, over at least one-half of all the counties mentioned in them, I should estimate about one-fifth of the whole to be hills, or lands inaccessible to the plough. Of the remainder, I calculate that one-third is under the plough, and two-thirds in grass, but all fit for aration. Of this last I take one-tenth only to be in artificial grasses, as the quantity of land under such bears very little proportion indeed to the old meadows. On these *data* the following will be the respective quantities.

	Sq. Miles.		Acres.
Hills and lands unfit for tillage - -	11,184	=	7,157,760
Arable land in tillage - -	14,913	=	9,544,320
Ditto in artificial grasses - -	2,982	=	1,908,480
Ditto in meadow or old grass, woods, &c.	26,845	=	17,180,800
	55,924	=	35,791,360

Thus it should appear that there are upwards of 17,000,000 of acres of arable land to which the plough does not reach. Making an ample allowance for gardens, &c. there should still be at least 15,000,000 acres of old grass lands, that have been accumulating in fertility for ages, and which, if ploughed up, would be highly productive in corn for a series of years; which, if the present lands in tillage were to be laid down properly into grass, from being altogether new to the culture, they would, in all probability yield as great a quantity of hay and foggage for cattle, as the whole of the old meadows do at present, although greatly less in point of extent.

As to the produce from tillage of the whole country, were it to be converted into the proposed rotation of nine years in grass, and seven years in tillage, I would estimate it thus:

	Acres.
From the total amount of the whole country - -	35,791,360
Take the amount of the hills, &c. - - -	7,157,760
Remains of arable land - - - -	28,633,600
From this deduct for houses, gardens, pleasure grounds, roads, &c.	4,633,600
There will still remain for husbandry - -	24,000,000
Of this there would be nine-sixteenths in grass - -	13,500,000
And in tillage, seven-sixteenths, - - -	10,500,000
Total as before - - - -	24,000,000

Of the lands in tillage there would be, according to the scheme proposed in the essay.

2	parts in seven -	3,000,000	acres, in wheat.
2	ditto in ditto - -	3,000,000	— in green crop.
$1\frac{1}{2}$	in ditto - -	2,250,000	— in barley.
$1\frac{1}{2}$	in ditto - -	2,250,000	— in oats.
7		10,500,000	

Again, suppose the wheat to produce thirty bushels, the barley forty, and the oats forty-eight bushels the acre, at an average; being calculated at the lowest rate, and that the price of the first should be 56*s.* the second 32*s.* and the last 26*s.* 8*d.* which is scarcely half the present prices, and surely not lower than they ought to be, when the present value of money is compared with the rate of labour. Suppose then the green crops to be equal in value to the average of the white, the amount and value of the respective crops will be as under.

Acres.	Bush. the Acre.		Quarters.		£.
3,000,000 in wheat -	at 30	=	11,250,000 at 56*s.*	=	31,500,000
2,250,000 in barley,	at 40	=	11,250,000 at 32*s.*	=	18,000,000
2,250,000 in oats,	at 48	=	13,500,000 at 26*s.* 8*d.*	=	18,000,000
7,500,000 white crop at 38.4 average.			36,000,000 at 37*s.* 6*d.*	=	67,500,000
3,000,000 of green crop, at £9. the acre, the average -					27,000,000
10,500,000 in tillage.					£94,500,000

In comparing this supposed annual produce with that, which may reasonably be expected from all the lands, at present under the plough in England and Wales, amounting, as was before supposed to 9,544,320 acres, two circumstances must be taken into consideration. First, the quantity of land in summer fallow which yields nothing; secondly, that the produce of such part as may be in crop, must be considerably less per acre, than from lands recently taken from old grass, because it is worn out, and exhausted in a great measure of its natural powers of fertility, from having been so long jaded under tillage. Having no precise data to go upon here, I must venture an estimate from probable conjecture only. Dividing the whole into seven parts, I shall suppose two in wheat, one-half in barley, one-half

in oats, one in green crop, and one in fallow; although probably in this last nearer two; and that the wheat averages twenty-four bushels the acre, the barley thirty-two, and the oats (commonly the worst of all,) twenty-eight, and the green crop as above, at the average of the white, the produce will be as under:

Acres.	Bush. the Acre.		Quarters.		£.
2,726,948 in wheat -	at 24	=	8,180,848 at 56*s.*	=	22,906,374
2,045,212 in barley	at 32	=	8,180,848 at 32*s.*	=	13,089,356
2,045,212 in oats,	at 28	=	7,158,242 at 26*s.* 8*d.*	=	9,544,322
6,817,372 in white crop at 27. 6			23,519,338 at 37*s.* 6*d.*	=	45,540,052
1,363,474 in green crop at the average of the white - -					9,127,095
1,363,474 in fallow yields nothing.					
9,544,320 acres in all, at £5. 14*s.* 6*d.* on the average of the whole.*					£54,667,147

But the advantage of the alternate system of grass and tillage by turns, over the present system of continued tillage on one part, and continued grass in another, will appear more striking, when the quantity sent to market from each is compared. It must be adverted to (what I believe is frequently overlooked in calculations on the produce of a country), that there is always a considerable proportion of a corn crop consumed on the land where it grows, in seed, in horse corn, and in food to the labourers in husbandry. Supposing this to be altogether only one quarter per acre for all the lands in tillage, which I have reason to believe is below the fact, the conclusion will be,

	Quarters.
From the alternate system as above, producing yearly in corn of all kinds - - - - - - - -	36,000,000
Take for farm consumption, per annum - - -	10,500,000
Remains for the market - - - -	25,500,000

* Produce, as before, by the alternate system,	£94,500,000
Produce by the present system, as above, -	54,667,147
Additional annual produce - -	£39,332,853

	Qrs.
But from the present continued system producing -	23,519,338
Take quarters per acre, as above, for farm consumption -	9,544,320
Remains only for market - - -	13,975,018

How far these different estimates may coincide with the real fact, in the one or the other system, it would be presumption in me to make a positive assertion. I apprehend however, that the estimate of the present product of English agriculture, at an average of twenty-seven and six-tenths bushels per acre, (if any thing faulty,) rather too high; whilst as to the other, I have seen so much of the productive powers of old grass lands when converted into tillage, that I am rather doubtful that calculating the average product of them at thirty-eight four-tenths bushels the acre, is below the real increase; of which, three-fourths will go to augment the rent, as the expense of labour will be very little more than in the present practice; and 4*s.* in the pound of this additional rent will bring in nearly £6,000,000 yearly to the state as land-tax, and leave still above 20,000,000 additional to the landlords, over and above the tithe to the church.

Again, supposing the number of people in England to be 10,500,000, of these 2,500,000 may be stated as solely employed in agriculture; and whose maintenance is comprehended in the quantity of corn retained for farm consumption. The remaining number, 8,000,000, being maintained from the quantity sent to market. Now, if instead of sending 13,975,018 quarters to market, as supposed at present, there should be 25,500,000 spared for that purpose, the country would be able to support upwards of 6,000,000 additional inhabitants, with all the additional horses, &c. which they may require.

No. CXLII.

FOOD FOR MAN FROM GRASS AND ARABLE.—*By Mr. W. Jones, of Fox-down House, near Wellington.*

I CONCEIVE that a general encouragement to convert wet heavy lands to tillage is of greater national concern than can be stated with respect to some other soils; because sands and loams, when in good condition, contribute a considerable portion to the sustenance of man in their present state, whereas the former are very deficient, and that in a much greater degree than might be thought, without a due consideration of the comparative difference. When such lands are appropriated to the dairy, or converted to tillage, I make that difference, from a minute calculation, to be as three and a half to one, in favour of the latter, when the lands are equally well calculated for pasture as tillage; and in cases where they are not, to be as five to one.

No. CXLIII.

EMBANKING.—*By Mr. John Smith, of Chatteris.*

I FIND from the public papers that the Premiums offered by the Board of Agriculture include draining low lands; and indeed, if stagnant water is not well drained off such lands, no improvements of any value, for either corn or grass, can ever be adopted on any fens, or low lands.

But previously to my describing a valuable and improved mode of banking, I will concisely observe, that the great level of the fens is divided into three large levels; and that each of these levels is subdivided into numerous districts by banks: but as these banks are made of fen moor, and other light materials, whenever the rivers are swelled with water, or any one district is deluged either by rain, a breach of banks, or any other cause, the waters speedily pass through these light, moory, porous banks, and drown all the circumjacent districts. The fens have sometimes sustained £20,000. or £30,000. damage by a breach of the banks; but these accidents seldom happen in the same district twice in twenty years; the water,

however, soaks through all fen-banks every year, in every district; and when the water mills have lifted the waters up out of the fens into the rivers in a windy day, a great part of the water soaks back through the porous banks in the night upon the same land again.

This water that soaks through the bank drowns the wheat in the winter, washes the manure into the dikes, destroys the best natural and artificial grasses, and prevents the fens from being sown till too late in the season. This stagnant water lying on the surface, causes also fen agues, &c. Thus the waters that have soaked through the porous fen-banks have done the fertile fens more real injury than all the other floods that have ever come upon them.

I have been much concerned in fen-banking from my youth, and though I now farm upon a large scale, yet I am still much employed in superintending fen-banking and draining low lands; not only in the fens, but also in some high land counties, at a considerable distance.

I had sometime back devised the plan which I now find to answer so well, but found it extremely difficult to prevail with any gentleman who possessed a proper district, to give it a trial: however, this last autumn, I prevailed with a gentleman in the parish where I reside to try the following plan, which proves equal to my most sanguine expectations.

PLAN OF IMPROVED BANKING.

I first cut a gutter eighteen inches wide through the old bank, down to the clay; (the fen substratum being generally clay,) the gutter is made near the centre, but a little on the land side of the centre of the old bank. This gutter is afterwards filled up in a very solid manner with tempered clay, and to make the clay resist the water, a man in boots always treads the clay as the gutter is filled up. As the fen-moor lies on clay, the whole expence of this cheap, improved, and durable mode, of water-proof banking, costs in the fens only six-pence per yard. This plan was tried last autumn on a convenient farm, and a hundred acres of wheat were sown on the land. The wheat and grass lands on this farm are now all dry, whilst the fens around are covered with water. This practice answers so well on this farm, that all the farmers in this parish are improving their banks in the same manner, and some have begun in adjacent parishes. If the plan be noticed by the Honourable Board, and published, it will soon spread through the fens, and other low lands, and produce inconceivable advantages to agriculture in many parts of the British empire.

No. CXLIV.

THATCH.—*By the Rev. Robert Duncan, Minister, near Kilmarnock.*

I HOPE to be excused for pressing, in the warmest terms upon all landed gentlemen, the propriety of slating their farm-houses and offices, not only for the security and comfort of the tenantry, but more especially for the greater improvement of the land. I am confident, tenants would rather pay an additional rent equal to the interest of the difference of expence between thatching and slating, and they would be amply repaid by the increase to their dunghills.

To illustrate this;—a farmer near me is, at present, employed, agreeably to the terms of his lease, in giving his dwelling-house and offices a new coating; that is, upon the old thatching he is adding a covering which, from the extent of roof, requires not less than an hundred thraves of oaten straw, each sheaf being a Scotch ell in circumference. Though none of the hundred thraves had been used for fodder, yet at a moderate computation, they would have served for four months as litter to fourteen horses, while feeding in the stable on red clover: consequently they might have contributed to fertilize three acres of land. This consideration, certainly deserves the attention not only of the proprietors of land, but of all feeders in towns, and villages, and the suburbs of cities. Though some manure be obtained when thatched houses are entirely new roofed, perhaps in the long period of fifty or sixty years, yet how immense the loss from the great number of thatched-houses throughout the united kingdom of Great Britain and Ireland.

(END OF THE PAPERS ON GRASS LANDS.)

MISCELLANEOUS PAPERS.

No. I.

The SPEECH *of the Right Honourable* LORD CARRINGTON, *delivered at the* BOARD *of* AGRICULTURE, *on Tuesday, March* 15, 1803.

ALTHOUGH it was the practice of our two last Presidents to lay before the Board, every year, a detailed account of all that had been done, and all that was proposed to be done, towards accomplishing the objects of our Institution, and afterwards to give the same to the Publick as a printed speech, I have not hitherto thought it necessary to adhere to this custom: But at the present moment, when I am about to quit the Chair, I have reason to believe that some account may be expected from me, of the conduct of the Board, during the period of three years, in which I have had the Honour to preside. I will therefore endeavour to bring to your remembrance some of the leading particulars of our Transactions, which, either from their own importance, or the peculiar circumstances attending them, have most attracted my attention.

Indeed, it cannot be thought necessary to arrange and class, under distinct heads, all the occurrences of our weekly meetings. They comprehend whatever relates to the improvement of the Agriculture of the Kingdom, in its various branches, and are well known to most of those who hear me. To excite Emulation and promote Inquiry; to encourage and diffuse improvements in the construction and use of Instruments for abridging labour; in adapting a proper rotation of Crops, and a judicious selection of Manures, to different soils; and to endeavour, for all these purposes, to combine the results of Science with the practical knowledge of Agriculture: to discuss new projects; to recommend such as are useful; to discountenance such as are visionary and impracticable; and, above all, to infuse into the minds of those Honorary Members that come among us, a just sense of the importance of the study of Agriculture as a Science, and of the practice as an Art;—these have been our constant occupations; and if it should appear that, in some instances, our just expectations of success have been disappointed,

still I think it must be admitted, on a review of our proceedings, that we have been usefully and honourably employed—honourably to ourselves, because usefully for the Publick. Passing by, therefore, the large field to which I have pointed, I shall content myself with noticing a few of the most prominent features of our Proceedings.

The first, and indeed the most important object of our attention, arose out of the Scarcity in the year 1800. Early in the spring of that year, the Board, with a wise and prudent foresight, took into consideration the state of the country, respecting wheat-corn: they had reason to apprehend that the stock was nearly exhausted, and were anxious to ascertain, as far as it could be then ascertained, what was the general expectation of the ensuing crop. For this purpose, I was directed to write letters of inquiry to all parts of the kingdom. The result was, with few exceptions, a full confirmation of the fears of the Board; it being apprehended that the last years' crop was almost entirely consumed, and that the growing one would be rather under the usual average on the dry and warm soils, and very deficient on the clays and cold lands. After much consideration on the subject, no remedy occurred to the Board, so certain, and economical, for supplying the expected deficiency, as the importation of a sufficient quantity of Rice from India.

I had previously consulted with some of His Majesty's Ministers, who, in consequence, made such Communications to the India Company, as led to an agreement on their part, to allow the importation of Rice from India, duty-free; but with specific directions to their Servants, "that (whether individuals should "engage or decline embarking in these speculations) they were by no means to "send any on the Company's account."

This permission, so restricted, appeared to the Board a precarious and inefficient remedy. In the month of June, I was therefore requested to communicate to the same quarter, the apprehensions of the Board, together with the letters which I had received in confirmation of them. Notwithstanding I met with every mark of attention from Government, yet from some cause, to me unknown, though unavoidable perhaps, on the part of the Directors, no alteration seems to have been made in the orders sent out to India; nor did the letters, conveying those orders, bear date till the 28th of August. The Parliamentary bounty on the importation of rice (which guaranteed a selling price of 35*s*. per cwt.) was, on the 2d October following, unfortunately suffered to expire. What followed we all remember.

The scarcity grew more urgent, and His Majesty was advised to call Parliament together early in the winter, to consider the best means of relief. The Bill granting a bounty on the importation of Rice, &c. was renewed, and continued to a long period. Great encouragement was held out to send ships to India; and nineteen thousand tons of Rice were imported from thence; but unfortunately it did not arrive till after the abundant harvest of 1801. The article, in consequence, became a mere drug, and the Government was called upon to pay no less a sum than three hundred and fifty thousand pounds, to perform the Parliamentary guarantee to the importers. It is evident, that had the exertions, which took place afterwards, been made with the same promptitude and success on the first application of the Board, besides the great relief which would have been afforded, this whole sum would have been saved; as the Rice would then have arrived at the most critical period of the scarcity, and have borne a high price. Nor is this all—to the pecuniary loss must be added, whatever was the difference in price at that time, and large it must have been, between a proportionate quantity of foreign corn imported (not less perhaps than four hundred thousand quarters) and the cost and charges of the Rice in question. Not wishing to dwell longer upon this subject, I shall only express my regret, that the Board were deprived of the satisfaction which they would have felt, had the information which their diligence had procured, and the timely suggestions founded upon it, been the means of averting any of the sufferings of the Publick at that important Crisis.

The next topick for your notice was one which has been made the pretence for calumny, misrepresentation, and invective, to a degree which has seldom been experienced by any Publick Body. Upon a cool and deliberate review of our conduct upon that occasion, I feel nevertheless, that the Board is not only undeserving of censure, but, in my judgment, entitled to commendation. I allude to Letters sent by order of the Board to the Sheriffs of the different Counties, to be laid before the Grand Juries at the Summer Assizes in the year 1800. The origin of that transaction you well remember. After the Board had suggested the measure above-mentioned for relieving the existing scarcity, they naturally turned their attention to the best means of preventing its recurrence; and nothing appeared so likely to prove effectual for that purpose, as the enclosure of the Waste Lands. In the midst of their inquiries, they received from the very respectable Baronet who acted as Foreman of the Grand Jury of the County of York at the preceding

Assizes, certain Resolutions upon this very subject, which they had entered into without the least communication with the Board. These Resolutions contained very forcible statements of the causes which had produced the great fluctuations of the price of corn in late years; of the insufficiency of the produce of the country for its consumption; and of the consequent necessity of converting to productive Husbandry the immense tracts of uncultivated Wastes.

This Communication exactly coinciding with the ideas of the Board, it occurred to them, that a concurrence of other Grand Juries to the same point might be the means of promoting so desirable an object; and I was therefore directed to transmit the Resolutions of the County of York to be laid before the Grand Juries of the different Counties at the Summer Assizes. The answers from most parts of the Country were highly favourable to the proceeding, and I was little aware of the attack that was in contemplation.

It so happened, that amongst the Resolutions of the County of York, which ran to great length, there had been introduced, towards the close of them, an observation, that the practice of taking Tithes in kind, was an obstacle to the improvement of Agriculture; and an opinion was given in favour of a fair and just Commutation of Tithes. This suggestion, however, was only collateral to the principal object, and had therefore not attracted at that time the attention of the Board, which had wholly and exclusively been bestowed on the Waste Lands; and I do not believe that a single Member recollected that the subject of Tithes, in general, had been touched upon. But in the Spring following, when, as Chairman of a Committee appointed by the House of Lords on account of the dearth of provisions, it became my duty to bring in a Bill for enclosing the Waste Lands (which had the misfortune to displease the great Legal Authorities in that House), a formidable attack was made, not so much upon the Bill directly, as upon the Board of Agriculture. The views and conduct of the Board were represented as inimical to the Church-Establishment: the application to the Grand Juries was severely reprobated; the only object of which was supposed to be an attack upon the institution of Tithes, under the pretence of enclosing the Waste Lands. The language of those Surveyors, who, at the commencement of the Board, had animadverted on this subject, were alluded to, as proofs to the same effect. In vain I stated, that though it was impossible to deny that the collection of Tithes in kind operated unfavourably to Agriculture, yet that it never had been the intention of the Board to call in question the general propriety of

Tithes as a provision for the Clergy; this being a subject which on no occasion they had ever discussed, conceiving it not to be immediately within their province; that the observations upon Tithes, which had been complained of, were printed many years ago; and that the Board had in the title-page of those very books, expressly disclaimed all responsibility for the particular opinions contained in them; each of those publications being intended merely as a general sketch (to be corrected by future inquiry) of the Agriculture of the particular County to which it related. In vain I urged this, and more. The opinions thus disclaimed were nevertheless made the grounds of attack upon the Board of Agriculture, by those Law Lords who disliked the Bill; which, whatever might be its defects, was certainly as little likely to endanger the Church-Establishment, as it was, in the opinion of those who framed it, well calculated to promote the Agricultural interests of the kingdom. The sentiments, which these great Authorities uttered in debate, have been since frequently revived and enlarged upon in some of the most violent periodical publications, as undeniable proofs of a conspiracy of the Board of Agriculture against the Church of England.

I shall trouble you to hear again the Resolutions of the County of York, although they have been frequently before us; and in recalling your attention to the Proceedings of the Board upon them, allow me to ask, whether any fair man can be induced to believe, that the Gentlemen who were present, whose names you will hear read, and who for talents, integrity, and estimation in the Country, may bear a comparison even with the Noble Lords alluded to, could so demean themselves, as to make a proposal, in itself avowedly unobjectionable, a pretence for introducing another of a totally different nature? The Board will recollect that, at that time, not one syllable on the general subject of Tithes was mentioned: the Waste Lands, and the Waste Lands alone, were the objects of our contemplation. The Secretary will now be pleased to read the Resolutions of the Board, of the 27th of May, and my Letter to the Sheriffs, of the 26th of June, which are irrefragable proofs of this fact.

EXTRACT FROM THE MINUTES.

Tuesday, May 27, 1800.

"PRESENT:

"THE RIGHT HON. LORD CARRINGTON, PRESIDENT,

THE RIGHT HON. SIR JOSEPH BANKS, BART. K. B.
THE SURVEYOR-GENERAL OF CROWN-LANDS, JOHN FORDYCE, ESQ. M. P.
DUKE OF BEDFORD,*
EARL OF WINCHILSEA,
EARL OF EGREMONT,
EARL OF HARDWICKE,
LORD VISCOUNT WENTWORTH,
LORD ROMNEY,
SIR CHRIST. WILLOUGHBY, BART.
SIR WILL. GEARY, BART. M. P.
SIR HENRY FLETCHER, BART. M. P.
SIR JOHN CALL, BART. M. P.
JOHN CONYERS, ESQ.
LANGFORD MILLINGTON, ESQ.
HENRY VAVASOUR, ESQ.

"Read and considered the following Resolutions of the Grand Jury of the County of York.

YORK, MARCH 15, 1800.

WE, the GRAND JURY of the COUNTY of YORK, impressed with a conviction, that at this crisis it is the duty of all, not only individually but collectively, to stand forward in the cause of their country, think it becoming to offer our sentiments to the public in the following Resolutions:

RESOLVED,

That it is melancholy to observe that corn has risen twice within the last five years, not only to double its usual price, but to double the price that, in the opinion of the Legislature, it ought to bear, since there is a law to allow the importation of wheat from foreign countries, with the trifling duty of 6*d.* per quarter, whenever it rises above the price of 52*s.* per quarter.

RESOLVED,

That although two severe visitations, succeeding each other very rapidly and recently, may seem to account for the present deficiency of corn, yet that a deeper investigation of the subject will bring forth conviction, that even the present scarcity is more truly attributable to a general deficiency of the annual produce of the country, as compared with its consumption, and that, in process of time, the evil is likely to become worse and worse.

RESOLVED,

That the produce of grain in this country falling short of the consumption, must be more strikingly evident, if we attend to the importation of corn in any given number of years last past, and particularly of the years 1794, 1795, and 1796,

* The Duke of BEDFORD was not present when the Resolutions passed, but His Grace's name was inserted in the Minutes by his particular desire.

which, by the Report of the Committee of Waste Lands, amounted in value to about eight millions sterling.

RESOLVED,

That it having been stated by the Privy Council, so long ago as the year 1790, that the value of corn imported, on an average of eighteen years preceding, was not even one-eighth of what it appears to have been since, in the years 1794, 1795, and 1796, is a proof that we are in a state of increasing demand upon other countries, and that to expect so great a deficiency as has been stated in the foregoing resolution, to be constantly supplied from foreign countries, must be delusive, if we consider that it is very generally believed that, in a common year, the produce of corn in Europe is very little, if any thing, more than equal to the consumption of its inhabitants, and that in any scarcity, recourse must be had to America; and that since the year 1790, it has been proved by experience, that America has not, in any one year, furnished much more corn and flour than was sufficient for seven days' consumption of this country.

RESOLVED,

That this country being in such a state of inability to provide, by its annual produce, grain for the annual consumption of its inhabitants, and having so scanty and precarious a resource in foreign countries, it is become a matter of most imperious necessity to consider of its future amelioration in this important respect.

RESOLVED,

That it appeared from the Report of the Committee of Waste Lands, that there remained in England, in common, waste, and uncultivated, the immense quantity of 7,800,000 acres.

RESOLVED,

That without asserting or imagining, that all these are convertible into a more productive state, it is evident, that in attention to this mine, lie the only true, permanent, effectual, and wise means of redressing our present, or securing against future wants, and of obviating the necessity of a precarious dependance upon foreign assistance.

RESOLVED,

That this country, happily possessing within itself the means of its own salvation, it seems a matter of clear, urgent, and necessary policy to call them into effect; and it is hoped that the wisdom of the Legislature will take into its serious consideration the framing of such laws and regulations as may best promote the immediate bringing into the best cultivation, all such parts as may be capable of it, of the great tracts of land that are now lying in the state above referred to.

RESOLVED,

That it seems a very well-founded opinion, that was given by the persons appointed to examine into and report upon the general state of Agriculture in this country, when they almost unanimously and uniformly declared, that the want of a fair and permanent compensation to the proprietors, in lieu of tithes in kind, is one of the greatest obstacles not only to inclosure, but to the due improvement of Agriculture.

RESOLVED,

That amongst other means which will doubtless occur, upon a due investigation of the subject, it will be useful to facilitate enclosure by lessening its expences; not merely by reducing certain fees that have been talked of, but by moderating the charges of solicitors, commissioners, and public meetings; by removing obstacles between party and party (of which fair and adequate commutation for tithes is a principal); and by giving encouragement to the more spirited management of land, and to Agriculture in general that respectability and importance in the scale of the public consideration, that it so pre-eminently deserves.

(Signed) GEO. ARMITAGE, Bart. Foreman.
THO. PILKINGTON, Bart.
CHARLES TURNER, Bart.
THO. SLINGSBY.
JAMES FOX.
JOHN DALTON.
EDWARD CONSTABLE.
W. SOTHERON.
THO. COORE.
CHRI. WILSON.
W. LEE.
ROBERT DENISON.
SAM. CROMPTON.
JAMES FENTON.
STEPHEN CROFT.
EDW. WILKINSON.
HALL PLUMER.
JOSEPH RATCLIFFE.
B. HEYWOOD.
J. BELL.
JOHN BECKETT.
CONYERS NORTON.
THOS. LUMB.

The BOARD then agreed to the following Resolutions:

"RESOLVED,

"That a Circular Letter be written by the President to the High Sheriffs of the respective Counties of the Kingdom, enclosing the Resolutions of the Grand Jury of the County of York, and requesting that they may be laid before the Grand Juries for their consideration, at the ensuing Summer Assizes:

"RESOLVED,

"That this Board will, immediately on its meeting after the Recess, take into consideration the propriety and utility of a General Enclosure Bill, and particularly the best method of enclosing small Commons and Wastes:

"RESOLVED,

"That, in the mean time, any information that can be communicated on the above subject, will be thankfully received by this Board, by Letter addressed to the President:

"RESOLVED,

"That the Board earnestly recommends the consideration of this interesting subject in all its branches, to the Official, Ordinary, and Honorary Members; and that they will be pleased to communicate the result of their inquiries to the Board, by Letter to the President."

(CIRCULAR.)

Copy of the Letter from the President of the Board of Agriculture to the High Sheriffs, dated June 26, 1800.

"The Board of Agriculture, deeply impressed with the distress occasioned by the great scarcity of the necessaries of life, have turned their serious attention to the best means of preventing a similar calamity in future. The result of their inquiry is an opinion, that the Enclosure of Waste Lands and Commons is one of the most likely means to effectuate this end. It gave me therefore much satisfaction to receive from the Grand Jury of the County of York, a copy of certain Resolutions which they had unanimously entered into, at the last Assizes, on this interesting subject. The scarcity has since so much increased, as to render their observations every day more forcible and just.

"I am desired by the Board to transmit to you these Resolutions, and to request that you would be pleased to lay them before the Grand Jury of the County of , at the ensuing Summer Assizes, together with the Resolutions of this Board, which I have also the Honour of sending enclosed. It is impossible to call the attention of the Publick to a subject of greater national importance; and should the respectable Bodies to which I have addressed myself, express their opinion in favour of the measure, by adopting these Resolutions, or by framing others more congenial to their own sentiments, I cannot but entertain the most sanguine hopes, that the attention of the Legislature may be speedily directed to carry these desires into effect, as the Board has already received from several Members of both Houses of Parliament, assurances that they will support any practicable plan of a General Enclosure which may be brought forward.

"I have the Honour to be, &c. &c. &c.

(Signed) "CARRINGTON, President."

But it was also urged by the Opponents to the Bill, that an application to the Grand Juries, on any subjects but those for the cognizance of which they are assembled, must necessarily be improper. I am free to admit, that Grand Juries ought never to be made parties to political discussions, though it cannot be forgotten that some of those who most vehemently objected to the conduct of the Board,

have in former times of great party heat, not always felt themselves restrained by this consideration. But I must contend, that to promote a plan for cultivating the Waste Lands, it would be difficult to find any Gentlemen more exactly fitted to act, than that description of which Grand Juries are composed; or any, whose opinions would have a greater effect on their Representatives in Parliament. They are always men of liberal education; many of them Acting Magistrates; and coming from different parts of the Country, must, from personal observation, be able to judge of the relief to be expected from this measure, in their particular districts.

With regard to the Bill, which, as Chairman of the Committee of the House of Lords, I had the Honour of proposing in Parliament, and which failed of success, it would lead me into too much detail, to enter fully into the consideration of it; and I am the less induced to do so, because, as I have already hinted, the objections made to the Bill rested chiefly on the general imputations cast on the Board of Agriculture, and not so much on any examination into the nature of its provisions. I will only say, that it was framed after mature deliberation, and seemed to be most peculiarly applicable to two descriptions of Waste Lands, namely, those where the Commons are so large, and the rights so mixed between different Parishes, that it is almost impracticable, in the ordinary way, to obtain *Consents*; and next, to those Wastes, of which the number in this country is immense, where the quantity of land is too small to bear the expense of a separate Bill. But it was hardly to be expected, that a measure which innovated on the common practice respecting Enclosures, and which, though without foundation, was considered as annihilating or abridging the profits of several descriptions of individuals, should pass without opposition. I should, however, have pressed the Bill forward, regardless of the formidable battery which had been opened against it, had not the Committee of Lords, who framed it, unfortunately suffered, in an evil hour, one of its leading provisions to be altered in a manner that, in my opinion, would have made the Bill in a great degree nugatory and ineffectual: I was therefore as anxious to have it withdrawn as any of those Noble Lords who opposed it.

Since that time the Bill has not been renewed, nor has the Board taken any subsequent measures on the subject. Their conduct, in this respect, has my full approbation. The crisis in which ihe Bill was produced, was particularly favourable to it. A scarcity, almost approaching to a famine, existed, and this measure was

loudly called for by the Publick. If, under such circumstances of pressure, those who had it in their power to administer the remedy, could suffer the passions, prejudices, or interests of others, so to mislead their judgment, what could we at this time expect from a similar attempt? If, after the fatal experience of more than twenty millions sterling having been sent to foreign countries for the purchase of grain, within the short period of a very few years, they can shut their eyes upon the past, and consider the present abundance as perpetual; if they can still condemn millions of acres, which are capable of every kind of produce, to remain dreary wastes—I can impute it to little less than to a species of infatuation. The case seems to me desperate; and I may almost say of them, in the forcible language of Scripture, "Neither will they be persuaded, though one rose from the dead."

The next important object that engaged the attention of the Board, was occasioned by a requisition from the House of Lords, who, in their inquiries into the means of removing the dearth of provisions, conceiving that many of the lands now under grass might be advantageously converted into tillage, applied to the Board for advice, under what regulations this change might be safely made. The Board, fully aware of the importance of the subject, and desirous of calling the publick attention to it, proposed, by advertisement, to give Premiums for Essays on "the best method of converting Grass-lands into tillage, and, after a certain time, of restoring them to grass again, with improvement, or at least without injury." This application from the Board had a great effect; no fewer than between three and four hundred Essays, from all parts of the country, were transmitted. Much time and labour were spent in examining their respective merits; and to no Member of the Board were we so much indebted on that occasion, as to the Noble Duke, who is now unhappily no more.

To prevent even the possible suspicion of any improper bias, the Essays were directed to be sent with marks, or mottos, and were adjudged by the Board without any knowledge of the names of the respective authors; and I have the satisfaction to say, that the principal rewards fell to those who, in the opinion of the country, stood the highest for Agricultural skill and talents. The Board, in this very delicate business, rendered more difficult by the great mass of matter, and the number of Claimants, had the full reward of their pains and labour: and though I am not so presumptuous as to assert, that the judgment of the Board was in every case precisely according to the merit of the Author, yet I think I may affirm, that

there are very few instances to the contrary; and that no measure in which the Board was ever engaged, gave greater satisfaction to the Publick, or produced more useful information. A part has already been published, and I flatter myself that another volume of Essays on the same subject will soon be ready.

While the Board was employed in these domestick objects of attention, it felt itself happy in becoming the medium of sending to the West Indies some of the most valuable productions of the East India Islands, within the same climates. From Dr. CAMPBELL, a worthy and ingenious Correspondent of the Board in Sumatra, they have obtained several parcels of Seeds (with accounts of their nature and properties), which, if they should be cultivated with success, may prove most valuable acquisitions to the West India Islands. They are at present on trial; but the House of Assembly in the Island of Jamaica have already been so sensible of their importance, that, by an unanimous vote they have returned their Thanks to your President.* A gold medal, the highest honorary reward bestowed by the Board, has been sent to Dr. Campbell; and I have no doubt, from his benevolence and publick spirit, that further supplies and greater varieties of Seeds may soon be expected.

Before I conclude, I must beg leave to notice a few circumstances relative to our domestick concerns: And first, with regard to our Publications.

I can truly say, that much the most painful and difficult part of my duty, has arisen from the effects of the prejudices excited by some of the early publications under the authority of the Board. I have already stated, that these were published merely as hints and conjectures, and that the Board expressly disclaimed all responsibility as to the particular opinions advanced in them. It must, however, be

* HOUSE OF ASSEMBLY,

Friday, 4th *December*, 1801.

RESOLVED, That the Thanks of the House be given to the Right Honourable Lord Carrington, President of the Board of Agriculture, for his attention to the interest of this Island, in transmitting the Selection of valuable Seeds mentioned to have been procured from the East Indies, which have been carefully deposited in the hands of the Island Botanist, with the descriptions and instructions sent out, in the hope of their successful cultivation.

RESOLVED, That Mr. William Mitchell be requested to communicate the above Resolution in the most acceptable manner.

By the House,

F. SMITH, Clerk of the Assembly.

admitted, that some of them were suffered to be printed without due examination, and that it will be our duty to expunge every exceptionable passage from the future editions. Indeed the Board has very strictly watched over their publications for the last three years; and though they are fewer in number than formerly, yet I may venture to flatter myself, that they are more correct, at least, that they contain nothing liable to the sort of objections above-mentioned.

It is much to be wished that the amended Reports of the Agriculture of the different Counties could be completed; but a sufficient degree of Agricultural knowledge is so rarely united to the power of explaining it with perspicuity and method, that notwithstanding all my endeavours, I have seldom succeeded in finding persons with sufficient ability and inclination to undertake this work. But as it is one of the greatest importance, I hope that the Members of the Board, in their respective Counties, will search for the most proper persons, and that they will also direct, encourage, and assist them in the detail.

With regard to our Finances, I must do the Noble Lord who preceded me the justice of declaring, that he left them relieved from the embarrassments to which they had formerly been subject. At present I have the satisfaction to say, that their situation is considerably improved; and yet I believe that no proper expence has been spared, but that, in all our proceedings, we have acted with a just liberality, which, with means as limited as ours, can rest only on the basis of economy. Our outgoings must necessarily be large. The two Secretaries deserve and receive considerable allowances: the other Gentlemen in the Office have also just claims to the remuneration bestowed on them. We are obliged to incur a considerable expense for rent, taxes, stationary, and office incidents. A large piece of ground at Brompton is kept in hand for Experiments, and suitable persons are appointed to superintend them. Add to this, honorary rewards (which in the single case of the Essays on Grass-lands, amounted to upwards of four hundred pounds, in addition to the Grant for that purpose from Government), the sums paid for surveying Counties, for forming a collection of books in Agriculture, for purchasing models and implements; and when it appears that all this is done from a Parliamentary Grant of only Three Thousand Pounds a-year, subject to the payment of Fees, and that we have now a considerable balance in hand, after having discharged all demands upon us, I think the Board cannot be denied the merit of an attentive and judicious

administration of their affairs, and that their conduct may be brought as an example to others, to shew how much may be done, with means comparatively small, when under prudent management.

I cannot conclude without adverting to a subject which I shall always consider as matter of peculiar pride and satisfaction to every Member of this Society. I mean the uninterrupted harmony and cordiality which has on all occasions prevailed in our intercourse with each other. A Society of this nature could never be extensive enough for its purpose, nor embrace all the talents most likely to render it useful, without comprehending persons who are in other respects divided by those political distinctions of Party which are found always to prevail in this free Country. Under the influence of these political distinctions, we have every day reason to see how difficult it is for those to act together kindly, even in the ordinary affairs of common life, who differ thus widely in their publick sentiments. But, happily, in this Board, although every Gentleman that belongs to it must, from his situation and rank in the Country, take a part more or less active in political discussions, yet, as if by common consent, the influence of every discordant opinion has been extinguished the moment he entered these walls. It is impossible to refer to any more striking instance of this liberal conduct, than in the person of the Noble Duke whose Bust is now in our view, and whose untimely loss we all equally regret. To the happy prevalence of this general disposition I must attribute the perfect unanimity which has prevailed amongst us during the whole period to which I have alluded. No sharp, angry, or vehement debates have taken place; and I am not aware that even a single expression has ever fallen from the lips of any Member, that could wound the feelings of another.

For myself, it is impossible not to acknowledge the partiality and indulgence which first placed me in this Chair, and have since uniformly supported me in it. That persons, who by their rank, and estimation in the Country, as well as by their knowledge of Agriculture, are confessed by all to be fittest for the first place (and any of whom it was my sincere wish and desire to have induced to undertake it, in preference to myself), should yet have condescended to accept from me the office of Vice-Presidents, must ever be highly gratifying to my feelings. With respect to the other Members of the Board, where I am so much indebted to all, it may not perhaps be strictly proper to mention any; but I cannot help saying, that to two of

the official Members, namely, the PRESIDENT of the ROYAL SOCIETY, and the SURVEYOR-GENERAL of the CROWN LANDS, I am under the most particular obligations: The various and extensive abilities of these Gentlemen, have been assiduously and uniformly exerted in assisting my endeavours. It would be ungrateful to deny, that their knowledge has instructed my ignorance; their information and experience have on every occasion aided or corrected my judgment; and their vigour and activity of mind have materially diminished the difficulties which I should otherwise have had to encounter, even in my imperfect attempt to discharge the duties of my situation.

To them, to the Vice-Presidents, and to the other Members of the Board, I once more beg leave to return my Thanks. It is my most ardent wish that their labours may long be continued with equal zeal and judgment, and with increasing credit to themselves and advantage to the Publick. The same kind and liberal protection which I have been fortunate enough to experience, will, I am sure, be extended to the Person, whoever he may be, whom their choice may destine to be my Successor. It is that, which can alone enable him to discharge with confidence and success his duty to the Board, and effectually to promote the wise ends of its Institution.

BOARD OF AGRICULTURE.

London, Tuesday, March 15, 1803.

PRESENT:

THE RIGHT HON. LORD CARRINGTON, PRESIDENT.

THE PRESIDENT OF THE ROYAL SOCIETY, K. B.
THE EARL OF EGREMONT,
THE EARL OF GALLOWAY, K. T.
LORD VISCOUNT WENTWORTH,
LORD VISCOUNT NEWARK,
LORD SHEFFIELD,
SIR CHRIST. WILLOUGHBY, BART.
SIR HENRY VAVASOUR, BART.
SIR GEORGE O. PAUL, BART.
SIR CECIL WRAY, BART.
JOHN CONYERS, ESQ.
WM. WILBERFORCE, ESQ.
LANG. MILLINGTON, ESQ.
THOS. ESTCOURT, ESQ.
JOHN FANE, ESQ.
THE REV. HENRY BATE DUDLEY.

On the motion of the Earl of Egremont, seconded by Lord Viscount Newark, it was resolved unanimously, that the Thanks of the Board be given to Lord Carrington the President, for the eloquent Speech which he has just delivered from the Chair; and that he be requested to furnish the Minutes of the same, to be entered amongst the Procedings of the Board, as it contains, in their opinion, a just and satisfactory illustration and defence of the views and conduct of the Board during his Lordship's Presidency.

AT A MEETING OF THE BOARD OF AGRICULTURE,

Tuesday, April 5, 1803.

READ the Minutes of the Speech of the late President.

RESOLVED, That this Speech be printed for the use of the Members, and that it be also inserted in the next Volume of Communications.

RESOLVED, That the Letter now read from Lord Carrington to the President, Lord Sheffield, acknowledging the receipt of his Lordship's Letter enclosing the Thanks of the Board, be inserted, together with the President's Letter, in the Minutes, and printed with Lord CARRINGTON's Speech.

Board of Agriculture, March 30, 1803.

MY LORD,

It is peculiarly gratifying to me, as President of the Board of Agriculture, to have been requested to transmit to your Lordship the unanimous expression of the high sense they feel, of the ability with which you presided in the Chair of the Board. To use any other language than their own, would be doing an injustice to the Resolution; I have therefore the pleasure of copying it.

"RESOLVED Unanimously, on the Motion of the PRESIDENT of the ROYAL "SOCIETY, seconded by the Earl of ROMNEY, That the Thanks of this "Board be given to the Right Honourable Lord CARRINGTON, for his "regular attendance on the meetings and other business of the Board; for his "able conduct in the Chair; and for his judicious management of their "affairs, particularly of the funds of the Board."

Permit me only to add, that this Resolution has my entire concurrence, and that it will be my wish to conduct myself on the same principles as those, which have enabled your Lordship to give such general satisfaction to the Board.

I have the Honour to be, with great regard,

MY LORD,

Your Lordship's faithful humble Servant,

SHEFFIELD.

The Lord Carrington,
&c. &c. &c.

St. James's-place, April 4, 1803.

MY LORD,

I beg that your Lordship will present my most respectful Thanks to the Board of Agriculture, for the great Honour which they have conferred upon me by their unanimous Vote. I cannot flatter myself that I deserve this distinction; but I am nevertheless proud to have received it, as a proof of their esteem and kindness. Be pleased, My Lord, to accept my best acknowledgments for the obliging expressions, in which you mark your own concurrence with the sentiments of the Board.

I have the Honour to be,

MY LORD,

Your Lordship's most obedient and faithful Servant,

CARRINGTON.

The Lord Sheffield,
President of the Board of Agriculture,
&c. &c. &c.

By Order of the Board,

SHEFFIELD, PRESIDENT.

No. II.

An Essay on the Management of Forests, by Monsieur Pannelier D'Annel;* *printed at the King's Printing Office in Paris, in* 1784; *translated from the French original, by Sir* John Talbot Dillon, *Knt. and Baron of the* S. R. E. *Under Secretary to the Board of Agriculture;*

Addressed to Sir John Sinclair, *Bart. then President of the Board of Agriculture, &c. &c. &c. with Notes by the Translator, and Extracts from the Reports of British Surveyors on the same Subject.*

WHEN the forest laws of France, and the Ordinance of 1669 were revised, the principal objects proposed, were to insure to the state in future, a supply of timber proper for the navy, and the considerable demands for house building in so extensive a kingdom.

For this purpose, it was deemed expedient to wait a long time before the trees came to their full growth. To have a great many of them, it seemed natural to wait, when numbers of trees were growing together: consequently the forests were left, either the whole, or the major part of them, to grow up in masses in a state of reserve: and it was ordained, that the quarter part belonging in mortmain to the church, or to bodies corporate, should likewise be reserved in the same manner.

Thus an intermediate produce, as well from the falls, as in money, which would flow from their being more frequent, was neglected, and sacrificed to a plan which it was conceived, at the time, could only be attained by a very tedious and general expectation. Nevertheless, an absolute and universal want of timber prevailed, as well of the primary sorts, to supply the demands of the navy, or to answer the purposes of civil architecture or commerce. Moreover, we daily witness the high price of wood for fuel necessary for domestic purposes, and the support of manu-

* In the year 1771 the fine forest of Compiegne was committed to the care of this intelligent surveyor, in order to give him an opportunity of realizing the effects of his new method, which he tells his Sovereign, Lewis XV. had answered so well, that it emboldened him to lay before his Majesty a succinct Report of his management in that fine forest, as now given; which, it was generally understood, met with great success, after his method was followed. *The Translator.*

factures. This evil is generally acknowledged in France, and that illustrious naturalist, Monsieur de Buffon, has more particularly pointed it out, in the most alarming manner, when he tells us, "That timber, formerly so common in France, "is now become so scarce, as to be barely sufficient to supply the indispensable "calls of necessity, and threatens us in future with an universal want. . . . . That "even those appointed to superintend our woods, complain of their decay: but it "is not enough to lament an evil we already feel, which will increase with time, "when we should endeavour to put a stop to it, and when every good citizen should "communicate to the public, the observations and experiments he has made on the "subject."*

Thus, from the proceedings abovementioned, the want of falls not producing the supplies expected, the returns in money are proportionably less, while the forests and woods, which had been a source of riches for a long time past, have not yielded what there was every reason to expect, and will also be totally exhausted, if a stop be not put to the decay of such parts, as may still be perpetuated; and if they do not by new plantations, replace such as cannot be regenerated.†

The cause of this evil is occasioned by the very method of felling the timber.

* Le bois qui étoit autrefois très-commun en France, maintenant suffit à peine aux usages indispensables, et nous sommes menacés pour l'avenir d'en manquer absolument. . . . . Ceux qui sont préposés à la conservation des bois, se plaignent eux-mêmes de leur déperissement, mais ce n'est pas assez de se plaindre d'un mal qu'on sent déjà, et qui ne peut qu'augmenter avec le temps. Il faut en chercher le remède, et tout bon citoyen doit donner au public les expériences et les reflexions qu'il peut avoir faites à cet égard.—*Buffon Hist. Nat. tom.* iii. *p.* 358. 12*mo.*

† When the very general spirit of planting amongst our nobility and gentry is maturely considered, it is to be hoped, that we are emerging from any difficulties to be apprehended on this account, notwithstanding what Mr. Nicholls, in his Letter to the Earl of Chatham, says, "That from having, by long experience, obtained some knowledge of the timbered state of this "country necessary to support the shipping of our navy and commerce, he is convinced, that the "demand very much exceeds the growth, and if some effectual means are not immediately taken, "either to lessen the consumption of oak timber, or to increase its growth, he fears *that the time* "*is not far distant,* when we shall be *greatly distressed for want of this useful article.*" The same writer adds, but with what degree of accuracy I am not competent to say, that he has "of late "observed with grief, a great diminution in the stock of growing timber, so much that he does "not believe there is one-tenth part of the quantity there was 20 years ago."—*Methods proposed for the decreasing the Consumption of Timber in the Navy. By Thomas Nicholls, Purveyor of the Navy for Portsmouth Dock-yard. Southampton,* 1793. T.

This is performed in the woods and forests in two different ways. By the first, timber is suffered to grow until a most remote period indeed, since the falls are only effected after 100, 200, or even 300 years. By the second, and better process, the coppices and underwood are cut at different periods, taking care every time to reserve a certain number of trees for standards.

What is the consequence of the first method?

That till the timber has acquired a very great age, it yields no income; and when it is felled, supposing it to consist entirely of oak, it neither affords proper timber for the navy, nor for large houses; the main objects of letting it remain so long in a growing state. Moreover, these forests have been suffered to grow for years in this manner, under an opinion of their having the proper sorts of timber for the navy; whereas, in general, they consist chiefly of beech, and yoke elm.*

I need not ask, if such, furnish timber suited for the purposes of ship-building?

The reason of this deception at the time, which still prevails, as a rooted prejudice in the minds of many, is the lofty and towering appearance of the trees, which forms an imposing object to the eye of an unexperienced surveyor, who traverses such forests rapidly, without the least attention.

Again, though the timber appears to be very towering, it is crooked and sinuous from the top to the bottom; of course, though the trees may be 70 or 80 feet high, they never produce a fine long stick, and much must be cut away, by which a great waste ensues.

With respect to thickness, independent of never being in proportion to the height, the stick suffers still more when it comes under the axe, than in squaring: that part which ought to measure twenty inches, will only give sixteen inches, even then including the sap near the bark. Besides, a stick worked upon, across the grain, and in every direction, contrary to its fibres, will only acquire a strained configuration, and becomes enfeebled from the treatment it receives.

Finally, timber trees suffered to grow in this manner, are absolutely deficient in quality, and moreover soft; a defect sufficient in itself, independent of dimensions, to render them useless for the great purposes of naval structure or house building.

Such being the state of forest trees of this description, growing in masses; it follows from hence, that timber of this kind will not afford a single stick proper for the great purposes desired. Such as are of inferior sorts, deficient in quality,

* Charme.

should never be made use of, more particularly in the navy; and if all the forests were suffered to grow in this manner, a sufficient quantity of timber would not be found, proper to build a single ship.

If this statement shall be inquired into, it will be found that the timber employed for the navy, and the principal supplies for houses were not furnished from the forests managed in the manner above-mentioned, but brought from woods, where the proprietors are accustomed to make their periodical falls at fixed *data*, and from those forests alone, where no expectations of acquiring timber for buildings of magnitude and consequence, had been formed. The city of Paris is principally supplied with timber from Champagne, which province likewise furnishes the sea ports with ship timber; and it may be further added, that all the forests which yield timber of this description, are managed by falls of the coppices, reserving a few standards. *

This fact, which is easy to prove, might undeceive those prejudiced persons, who have adopted the system of suffering trees to grow for so long a term, under the apparent idea of advantage: if such persons would only take the trouble of visiting these forests, and of seeing every thing themselves, they might at least discover the places, from whence our timber yards are supplied with such fine sticks, as are seen there; as well for building houses, as for ships. In short, they would learn the methods of managing those forests, from whence such timber comes, and where they are so eager to prefer the old method, and other similar ones, under various denominations, respecting which, it is of little moment what form they have, or by what appellation they are known, † as they make still, in a less degree,

* This is what the French woodmen term *Futaie sur taillis*, by far preferable to the old method of letting the timber remain for a very long period, and grow up in immense masses, which Mr. Pannelier calls *Futaie en massifs*; but the technical term for such growing timber in general is, *Bois de haute futaie*. T.

† Such as, for instance, amongst the French woodmen, the terms *grand massifs*, *bouquets*, *bordures*, and *lisières*. The distinction of woodlands made by our surveyors seems more accurate. These are classed in three divisions.

1st. Woods, consisting of timber trees and underwoods.

2d. Coppice, or underwood.

3d. Groves, or spring-wood of trees only.

Respecting timber trees with us, all oak, beech, chesnut, walnut, ash, elm, cedar, fir, lime, sycamore, and birch trees. By the statute 6 Geo. III. (to protect woods and coppices, and to

a part of the old system of trees growing in masses, and have all their inconvenience, from not participating of the advantages of trees that stand separate.

The last fate of such forests is, that the sticks do not shoot again, or if the soil, perchance, should make them reproductive, they would only yield an inferior sort, or there would not be shoots enough to stifle the seeds of willows and ash, scattered through the woods by high winds.

The inutility then, the inconvenience, and consequently the abuse of waiting so long for a fall of timber, having been thus demonstrated, it remains to treat of the second method.

This is the only good one, provided however, that it is pursued with judgment; for it sometimes happens, that no fixed rule is observed. Coppices are cut at all ages, even at ten years, and at the same age they reserve a great many trees, more or less, which are often cut too soon, and always without a progressive order; from whence it follows, that these coppices being generally cut too soon, the reserves left for standards, never become fine trees.

Therefore, when the falls are too early, they never produce timber for buildings of the first sort; and much less in quantity of the other sorts, than they ought to do; as well because the cuttings are too frequent, as because the too great number of reserves prevents their growth, and stifles the underwood.

Consequently, the income, in the return of money at the sales, is much below what it ought to be.

The question then arises, how are the forests to be managed, to afford proper timber for the great purposes of the state? in point of quality and dimensions, and to obtain from the falls the greatest return in money, that such an estate is susceptible of?

In answer: this can only be done by consulting nature, and watching its progress, which will point out the proper periods for the falls.

It is a fact, that trees growing together, and too close to each other, particularly oaks, shoot up without ever acquiring bulk; and besides never grow straight. If they are insulated, they do not shoot any higher. When young standards are

punish wood-stealers, and offences committed thereon), shall be deemed and taken to be timber trees, within the true meaning and provision of that Act.—*See Letter to Sir John Sinclair, Bart. from John Robinson, Esq. Surveyor General of Woods and Forests. April,* 1794. *P.* 51. T.

left in a coppice judiciously cut, yet surrounding them on all sides, it stifles the younger branches of the standards, as they spread out, by depriving them of sunshine, and a free circulation of air; it follows from hence, that the sap, less diverted through a variety of channels, shoots direct, invigorates the main stem, and contributes much to its thickness, as well as something to its height, which renders the tree more valuable in proportion to its length, when it comes to be squared. Thus, at their due periods, trees are sure to acquire bulk, and become straighter as they grow up: whereas if left too long, they languish and finally decay; the reason is, because having been too long screened by remaining in thick groves, for a long period of years, they are afterwards unable to resist the inclemencies of the weather, and cold blasts, which assail them on all sides. The standards perish from the same causes when left too long, and their heads decay; or else for want of bulk proportionate to their height, they are blown down, or shivered by violent gusts of wind. *

These observations have not been made by surveyors, because they have made no observations at all: besides, the very effects themselves resulting from their regulations demonstrate the fallacy of reasoning, as well as the prejudices in favour of the old system. These men, considering only, in a transient manner, the great wants of the state, which may occur at a future period, have solely had in view, as was mentioned before, the necessity of waiting a long time for the growth of timber, and a great quantity of it. Had they consulted nature, they would have been convinced, that it is beyond its powers to afford to masses of trees, growing in great numbers, and close to each other, all that vigour and dimensions they fondly expected. They ought to have foreseen, that timber shooting up without increasing in bulk, or being straight, can never answer the great designs of building on a large scale, but rather evince on the other hand, the proper periods for the falls, by teaching us, that if it is done too soon, we shall have no sticks proper for

* Mr. Naismith, in his Survey of Clydesdale, drawn up for the consideration of the Board of Agriculture, says, " That in Scotland the young oak is less patient of the blast than most of the trees of the forest. Being late in putting forth its leaves, it continues to grow till the season is far advanced, and the immature wood of its late shoots unable to resist the piercing effects of the winds in exposed situations, withers before the next spring; so that like Penelope's web, the progress of one season is undone in the following." T.

reserves; and if too late, the standards, granting that they do not decay, are no longer in that juvenile vigour, which would enable them to become straight as they grow higher. *

The general system of management proposed as an improvement, will be found laid down in the subsequent observations: it has been practiced in a few forests, and they are the only ones where good timber has been raised for capital structures; all that is now claimed is to introduce it, with such ameliorations as it may require. The Minister of State, Abbé Terray, had prevailed on the King to adopt it in the forest of Compiegne in the year 1771, and it success has answered every expectation. †

These regulations consist in carefully examining the nature of the soil, the wants of the country, and the demands of commerce, in order to regulate the falls at

* In the Report of Clydesdale, which I have just had occasion to mention, it is particularly noticed, that it has been long the custom in that country to leave 20 or 25 trees, called *reserves*, or *willers*, in an acre, at each cutting, to furnish purchasers with an assortment of wood, which practice Mr. Naismith deems an injurious one, when those trees drawn up long and slender by the shelter of the surrounding wood, stand in an exposed situation, they are unable to bear the blast after they are left single, and, if they are not quite stunted, make little acquisition of size. Should they happen to thrive, they do more injury to the young growth around them, than all the additional value they attain. T.

† A management in some degree similar to this, as being the practice of the North Riding of Yorkshire, is pointed out by Mr. Tuke in his accurate survey of that district, drawn up for the consideration of the Board, p. 88. "This method (he adds) of going over the woods about every "twenty years, seems to raise the best trees and greatest quantity of timber, because the wood, "suffering little alteration, affords the most uniform and regular protection to the growth of the "trees, and probably is the most profitable mode of managing wood lands. In these woods some "of the timber arrives at proper maturity before it is cut down, and is fit for ship-building, or "any large purpose. No objection seems to arise to this mode of management except the addi-"tional trouble that is required at the time of felling the timber, to prevent it in its fall from "doing any injury to that which is intended to remain." T.

To reverse the medal for a moment, what a contrast we find in the county of Huntingdon, which, it is to be hoped and presumed, is seldom the case in other counties of this luxuriant kingdom. Speaking of oak timber, Mr. Stone says, "It is not much raised in this county, and "there is very little fit for the navy; it is usually cut down when it begins to be most valuable "for that purpose, and consequently when it ought to be spared. As to *underwood*, it is not "carefully selected and planted, the production of it both in quantity and quality is, for the most "part, left to chance." However, in all this, there may be local circumstances respecting the soil

periodical seasons, judiciously appointed, according to years and circumstances. Then you may expect productive underwoods, with standards that will rise up to fine trees: that is to say, trees that will have the utmost height and bulk possible for their age. I am ready to allow, that the standards may perhaps not be so tall as the trees, on the old principle; but they are straight, and proportionable in bulk to their size, and the period of the falls, yielding sticks from thirty to sixty feet long, and sometimes more; having all the thickness to be expected; and as single trees, enjoying the benefit of sunshine and free air, they have all the solidity and substance accruing from the soil and climate: in a word, *they have* what the other trees according to the old school, *have not*; every thing which nature can supply them.

In fine, this management consists further in consulting the proper time for a fall, when the stubbs shoot out, and the reserves are in a flourishing state, in numbers sufficient for a fall at the most advantageous periods; that is from 20 to 40 years. It is at the returns comprised in these two terms, that the woods should be felled, but never under the term of 20 years, those coppices excepted, planted with hazle, chesnut, and willow, which need not wait so long as 20 years. All stubbs, too old to shoot again, should be grubbed up, and the ground planted again, to fill up the spaces; for particular attention must be given to replanting, as stopping the progress of an absolute decay respecting such trees as may be perpetuated, and replacing those which cannot be regenerated, are the only two methods to restore a forest fallen into decay.

With respect to the first mode, it has been just now set forth: as to the latter, it is reduced to the necessity, that the earth be well turned up, two feet deep at least, for replanting the scion, so that its roots may shoot in every direction. Should the soil prove tenacious, the roots cannot penetrate, unless the earth be well turned, and to a sufficient depth. Should the bottom be bad, the good earth at top will then be removed to the bottom, where the roots spread. It is recommended to prefer a scion from a nursery, because those that shoot up in woods have meagre roots, with tough and stiff fibres. Set them as little late in the season as possible, because

and situation of this county in particular, that may not affect other places in general, of which the same intelligent Surveyor has given us a brilliant instance in his valuable Report of the county of Bedford, whose numerous and beautiful plantations do so much honour to those who have undertaken them with so much laudable zeal and public spirit. T.

they will begin to take root in the winter, whereas those planted in February or March, run the risk of being blighted in a dry spring, when those set in the ground in November or December, are already in vigour. In a word, plantations must be attended to, because it would be giving up all prospects, and success, if we were to omit the proper care and attention to a point of such moment; since to fail in a principal part, is as bad as to neglect the whole.*

With respect to the determining on the number of standards for each fall, we

* The universal spirit of plantation so prevalent of late years in this country, not only deserves the highest commendation, but affords moreover every pleasing expectation to futurity. I cannot omit naming on this occasion, that celebrated planter Sir Archibald Grant, of Monimusk, of whom Dr. James Anderson, in his very valuable survey of the county of Aberdeen, informs us, that he had planted no less than FIFTY MILLIONS of trees, and that at the time of his death there were some trees of his own planting that were near *one hundred feet high*, and about six feet in diameter. T.

Upon this subject much more might be added, were this the proper place for such a discussion; or, were I permitted for a moment to turn my view from the venerable British oak to the lofty oaks of Spain, I should beg leave to mention a most famous tree of that kind, which grew in the province of Valencia, whose fertile plains I had the pleasure of traversing in 1778. This majestic and stately oak grew in a wood near the village of Burjasot, three miles from the city of Valencia. Its branches are said to have covered as much ground as a pair of oxen could plough in a day; its branches were forty-eight feet diameter, of which there were fourteen principal ones, each of which separately would make a fine tree, and were supported by props, which gave to this wonderful production the appearance of a temple of Druids; yet the principal trunk was not above fifteen feet in circumference. Escolano, a Spanish writer, says, he saw the tree, and has described it circumstantially. It was destroyed by lightning in 1670; of the small branches they carried to the Patriarchal College, in Valencia, upwards of forty cart loads, and the remainder was sold on the spot to a builder. T.

The preservation of forests was an object particularly attended to by Philip II. King of Spain. When that monarch appointed Don Diego de Covarrubias to be President of the Council of Castile in 1582, he seems to have foreseen what has since happened in Spain, when in the commission granted to that officer he thus expresses himself:

"One point we are very desirous of accomplishing, and that is, the means of preserving the "forests of our kingdoms and improving them, which we conceive is greatly wanted, as we consi- "der them to be in a very decayed state. We are therefore fearful, that those who come after us "will reproach us with suffering them to have been wasted, and God forbid that we do not see "this come to pass even in our own days."——*Viage de Espana, por Don Ant. Ponz, Tom.* vii. *Madrid*, 1778. T.

must lay down a fixed principle, and act accordingly, that a given extent of ground can only allow of a given number of trees.

By establishing this rule and proportion, we may expect to raise a quantity of good timber, and when we are thus well stocked, we shall also have an ample supply of coppice and underwood of every kind, and for every purpose; from whence it will follow, that the greatest income possible in money will be obtained, and thus every desired purpose be answered.

On every acre, there must be a number of trees reserved at every fall, corresponding with the period at which the cutting is regulated; the greater number to consist of oaks, and the surplus of beech, elm, ash, or other trees, which exigencies may require.

By means of the reserves at each first fall, the forests where, on these occasions, all the necessary trees will be found, will then be supplied with numerous standards of all ages and sorts intended.

Then it will only be necessary to preserve on each acre, a fixed number of standils of the same ages, and of the same kinds, to be felled consecutively, at their corresponding terms: for inasmuch as at every course, they will only have a fall of reserves of different ages, in proportion with what is left standing, to effect a renewal, it must be waited for, on the ratio of the fall, the whole according to the tables herewith, which method is recommended as by far the best suited for the purpose required. *

* As these tables are made out in *arpens* of French measuremeut, it may not be amiss to observe that a French *arpent* is equal to one acre, twenty-nine poles, nine paces, three-quarters of a rood, English measure. Thus the French *arpent*, consisting of 100 perches of 22 feet each, making 48,400 square feet *French*, or 51,691 *English* square feet; this is according to Mr. Greave's calculation, who makes the English foot in Guildhall to be 1,000, and the Paris foot of the Chatelet 1,068.

On the other hand, according to the dictionary of the French Academy, the *arpent* consists commonly (*ordinairement*) of one hundred square perches; and, from the same authority, the perch contains from 18 to 20 or 22 feet, or *pieds du Roy*, in different provinces. T.

Though it is of no material consequence in this instance, it may nevertheless be observed, that the author of the annexed Tables has not expressed on what kind of *arpens* he grounded his calculations; Mr. Arthur Young informs us that the *arpens* of Paris, and the *arpens* of France, are both legal and common measures, notwithstanding which, they are of very different contents,

As to the choice of standards, all that can be said is, that we must always reserve the finest sticks, and the most promising, whose appearance are most likely to answer expectation. Such a selection doubtless requires all the experience and judgment of one, perfectly competent to decide on such matters.

Forests being thus managed, the falls will be attended to at the proper terms, with a due care of the reserves: the whole will then be in its full value, except in those woods wherein, at the time of the falls, there were not found all the trees or coppice sufficient, and excepting the saplings replaced.

It is of course understood, that they will not immediately find reserved trees fit for the axe, and for every purpose required: when this circumstance happens, the event must be left to time to give them the proper dimensions; a skilful surveyor will do the rest to bring them forward to that desired period.

From the moment this method shall have been established, the causes of former evils will cease, the forests will be more productive in proportion as this system of management shall acquire a progression, until perfectly completed. The fostering hand of time will then do the remainder, crown the labours of the woodman, and raise the forests to their highest pitch of estimation.

Then, not only the produce, as well in timber as coppice, and underwood of every kind, and of course the returns in money will rise to the highest possible degree of value, and this source of national wealth will become not only exuberant, but even inexhaustible, since the income of forests under a similar management will be perpetual.

What is here alledged respecting the increase of income, from the falls in the manner represented, is proved by calculations, not raised on any hypothesis, but founded upon facts.

Whoever will examine and compare the same with the old system will find,

1st. That coppices, though cut too soon, will produce more than old timber, left in the former manner.

2dly. That coppices treated according to the new system, will yield a greater revenue than those cut too early, and will afford to the demands of the public,

and what is strange to say, are sometimes confounded by French writers on Agriculture, even by societies in their public memoirs. *Travels through France by Arthur Young, Esq. F.R.S. Secretary of the Board of Agriculture, &c. 2d Edition, Vol. I. London, 1794.* T.

resources not to be found in the lofty masses above-mentioned, or in the common method of cutting underwoods. *

From all these premises we may reason truly, and draw an inference of the certain profits arising to the public, from following the new management recommended: we shall perceive the benefits ensuing therefrom in proportion as the system becomes more general. Finally, we shall be able to form a right judgment under this practice, when the periods of time revolve, to confirm the above: we shall then see that independent of the returns in money, which will be carried to the highest amount, by the quantity of underwood of every sort furnished, there will be moreover infinitely more timber for building than at present, so that instead of experiencing annually a more apparent and total decay, we shall rise into plenty, and a progressive abundance. †

To sum up then the whole of what has been advanced, and to evince that the waiting so long without a fall in expectation of forest timber, is erroneous, we shall now conclude, with hopes that we have proved,

1st. That letting so many years elapse without a fall, instead of fulfilling the object desired, is a certain means of disappointment of the advantages expected.

2d. That such erroneous methods are infinitely prejudicial, since by being so long a time in advance for expences, we sacrifice during that period to a vain expectation, the more certain income which would occasionally flow in money and produce.

* According to the practice of the county of Rutland, we are told by Mr. Crutchley, in his valuable report of that County, that the underwood is cut from 12 to 16 years growth; some woods are good, others are not so good, owing to their having been cut too high from the ground, and not early enough in the season. Mr. Crutchley is of opinion that all underwood should be cut as soon as the leaf is off, and not more than four inches from the ground, which would greatly invigorate the spring shoots, as he says woods so cut and managed, in the course of twelve years, will net more by two pounds an acre than if cut high. Draining of woods is another improvement recommended by the same writer, from which much benefit would arise, by making open gripes to carry off the water, which gripes should be opened every third year at farthest.

† It is judiciously remarked by Mr. Cruchley in his report of Rutland, from which I have taken the liberty to select an observation respecting the cutting of underwood, that "A trading "country like England will always want timber; and the consumption of it in time of war is so "great, as to make it the interest as well as the duty of gentlemen of fortune, to promote the "growth of timber. Besides, that it adds much to the beauty and improvement of their estates "to plant upon them such forest trees as may best suit the soil and situation." T.

3d. That from such errors we may date the total decay of our forests.

4th. That the only remedy which should have been adopted at the time, and to which it is indispensably necessary to recur, is to cut the underwoods, at those periodical returns of years, when the stubbs shoot luxuriantly, and the standards are in a thriving condition.

5th. That the ages for the falls should be settled from 20 to 40 years; by no means earlier than 20 years, that the coppices may have some degree of vigour to produce a good fall, with standils reserved of a promising appearance, and not later than 40 years, as after that date they will decline, or at least improve no further.

6th. That the management as above recommended, is the only judicious method of preserving forests, so as to be of any service to the state, and far preferable to the old system of waiting such a number of years; since it is in vain to expect therefrom a supply of timber or underwood of every sort.

The above deductions are founded upon the basis of physical truth; should they be controverted, facts will speak for themselves. Can any authorities or allegations withstand the power of truth? or must we submit to render facts subservient to floating opinions? In any question, of the least moment, we do not hesitate on what conduct we should follow: in the present instance, we have before us, no less than the first claims of civil society, viz. to provide support for our manufacturers, to give activity to our commerce, and power to our navy.

APPENDIX.

With respect to the above-mentioned regulations of Mr. Pannelier as a practical surveyor, they must undoubtedly rest upon the authority of that success, which he assures his Sovereign he met with, in the royal forest of Compiegne; but with regard to ourselves in this happy and flourishing island, in vain would our forests shoot up with the utmost luxuriance! In vain, would our victorious ships, built with their timber, cover the immense ocean with their canvas, should other branches of agriculture not be promoted, or the labours of the plough cherished, with unremitting ardour. To these we must look up for our solace, our real felicity! If

the writers of France and Spain have bestowed encomiums on our industry and tillage, as pointed out by the Honourable President, Sir John Sinclair, in his last Address, let it encourage us to redouble our efforts, and to consider them as rather tending to what Agriculture might do, than what it had done hitherto! May all these efforts be united under the new establishment, and may the success of such endeavours diffuse universal happiness throughout the Empire, and render the Board of Agriculture one of the brightest gems of the British diadem.

JOHN TALBOT DILLON,

Under Secretary to the Board.

Board of Agriculture, Sackville Street, Sept. 10, 1804.

P. S. Having already mentioned, in the course of this translation, the Essay by the late John Robinson, Esq. Surveyor General of Woods and Forests, " on the subject of inclosures, improvements of commons, and waste lands," I beg leave, in further illustration of the annexed Tables of M. Pannelier, to refer the reader to the aforesaid Tract, p. 37, where extracts are given from our Statute Books of the laws respecting *the preservation of timber trees, woods, and underwoods, and the number of standils per acre to be left, on cutting woods,* &c. after which I humbly presume I cannot close the subject more properly than in the words of the same judicious and intelligent writer, where he says, " The great benefits that will result to this kingdom, by establishing a " system for the growth of wood and timber on our wastes, especially on those, best and most " adapted for this purpose (and many of them are such as cannot be otherwise cultivated,) are so " self evident, that I will not trouble you by particularly stating them, only remark, that the " decrease of timber in this country is felt; and that every measure the legislature can take to " encourage and promote the growth of wood and timber, appears to be called for, as highly wise " and politic, more especially as the inclosed lands within the kingdom are daily continuing to be " thrown into agriculture, more than into wood."

[To face Page 262.

Tables of Reserves and of Falls of Standils in a Forest of 10,000 Arpens,

Stated by Monsieur Pannelier D'Annel.

It is supposed that these Falls are to take Place at one or other of the Periods of 20, 25, 30, 35, and 40 Years, conformable to the Plan proposed in the Essay on the Management of Forests.
This TABLE exhibits the progressive Order of RESERVES and FALLS according to their respective Dates.

At Twenty Years.

500 Arpens. Annual Fall.
Number and Ages of the Standers.

RESERVES, On each Arpent.

	Years.	Oak.	Beech.
At	20	12	2
	40	6	1
	60	5	1
	80	4	1
	100	3	1
	120	2	0
		32	6
Total		38	

FALLS, On each Arpent.

	Years.	Oak.	Beech.
At	40	6	1
	60	1	0
	80	1	0
	100	1	0
	120	1	0
	140	2	1
		12	2
Total		14	

Thus on 500 Arpens.

RESERVE.

	Years.	Oak.	Beech.
At	20	6,000	1,000
	40	3,000	500
	60	2,500	500
	80	2,000	500
	100	1,500	500
	120	1,000	—
		16,000	3,000
Total		19,000	

CUT.

	Years.	Oak.	Beech.
At	40	3,000	500
	60	500	—
	80	500	—
	100	500	—
	120	500	500
	140	1,000	—
		6,000	1,000
Total		7,000	

Stock of the Forest in Standils.

	Years.	Oak.	Beech.
At	20	120,000	20,000
	40	60,000	10,000
	60	50,000	10,000
	80	40,000	10,000
	100	30,000	10,000
	120	20,000	—
		320,000	60,000
Total		380,000	

At Twenty-five Years.

400 Arpens. Annual Fall.
Number and Ages of the Standers.

RESERVES, On each Arpent.

	Years.	Oak.	Beech.
At	25	12	2
	50	7	1
	75	4	1
	100	3	1
	125	2	1
		28	6
Total		34	

FALLS, On each Arpent.

	Years.	Oak.	Beech.
At	50	5	1
	75	3	0
	100	1	0
	125	1	0
	150	2	1
		12	2
Total		14	

Thus on 400 Arpens.

RESERVE.

	Years.	Oak.	Beech.
At	25	4,800	800
	50	2,800	400
	75	1,600	400
	100	1,200	400
	125	800	400
		11,200	2,400
Total		13,600	

CUT.

	Years.	Oak.	Beech.
At	50	2,000	400
	75	1,200	—
	100	400	—
	125	400	—
	150	800	400
		4,800	800
Total		5,600	

Stock of the Forest in Standils.

	Years.	Oak.	Beech.
At	25	120,000	20,000
	50	70,000	10,000
	75	40,000	10,000
	100	30,000	10,000
	125	20,000	10,000
		280,000	60,000
Total		340,000	

At Thirty Years.

333 Arpens. Annual Fall.
Number and Ages of the Standers.

RESERVES, On each Arpent.

	Years.	Oak.	Beech
At	30	12	2
	60	7	1
	90	5	1
	120	3	1
		27	5
Total		32	

FALLS, On each Arpent.

	Years.	Oak.	Beech.
At	60	5	1
	90	2	0
	120	2	0
	150	3	1
		12	2
Total		14	

Thus on 333 Arpens.

RESERVE.

	Years.	Oak.	Beech.
At	30	3,996	666
	60	2,331	333
	90	1,665	333
	120	999	333
		8,991	1,665
Total		10,656	

CUT.

	Years.	Oak.	Beech.
At	60	1,665	333
	90	666	—
	120	666	—
	150	999	333
		3,996	666
Total		4,662	

Stock of the Forest in Standils.

	Years.	Oak.	Beech
At	30	120,000	20,000
	60	70,000	10,000
	90	50,000	10,000
	100	30,000	10,000
		270,000	50,000
Total		320,000	

At Thirty-five Years.

285 Arpens. Annual Fall.
Number and Ages of the Standers.

RESERVES On each Arpent.

	Years.	Oak.	Beech.
At	35	12	2
	70	7	1
	105	5	1
	140	3	1
		27	5
Total		32	

FALLS On each Arpent.

	Years.	Oak.	Beech.
At	70	5	1
	105	2	0
	140	2	0
	175	3	1
		12	2
Total		14	

Thus on 285 Arpens.

RESERVE.

	Years.	Oak.	Beech.
At	35	3,420	570
	70	1,995	285
	105	1,425	285
	140	855	285
		7,695	1,425
Total		9,120	

CUT.

	Years.	Oak.	Beech.
At	70	1,425	285
	105	570	—
	140	570	—
	175	855	285
		3,420	570
Total		3,990	

Stock of the Forest in Standils.

	Years.	Oak.	Beech.
At	35	120,000	20,000
	70	70,000	10,000
	105	50,000	10,000
	140	30,000	10,000
		270,000	50,000
Total		320,000	

At Forty Years.

250 Arpens. Annual Fall.
Number and Ages of the Standers.

RESERVES On each Arpent.

	Years.	Oak.	Beech.
At	40	14	2
	80	8	1
	120	4	1
		26	4
Total		30	

FALLS On each Arpent.

	Years.	Oak.	Beech.
At	80	6	1
	120	4	0
	160	4	1
		14	2
Total		16	

Thus on 250 Arpens.

RESERVE.

	Years.	Oak.	Beech.
At	40	3,500	500
	80	2,000	250
	120	1,000	250
		6,500	1,000
Total		7,500	

CUT.

	Years.	Oak.	Beech
At	80	1,500	250
	120	1,000	—
	160	1,000	250
		3,500	500
Total		4,000	

Stock of the Forest in Standils.

	Years.	Oak.	Beech.
At	40	140,000	20,000
	80	80,000	10,000
	120	40,000	10,000
		260,000	40,000
Total		300,000	

From the above Tables it will be easy to calculate the Quantity of Wood of every Dimension which the Forests will yield on the whole annually, either for Building, or otherwise, when the Management is conducted as proposed.—It will then be no longer necessary to look for these Supplies at a Distance, and heavy Expence, when we are surrounded by Forests, and the Admiralty will more readily know where to apply for such Stores, since they will be found every where.

N. B. The Reserves, exclusive of Oaks, may be made of any other Trees required.

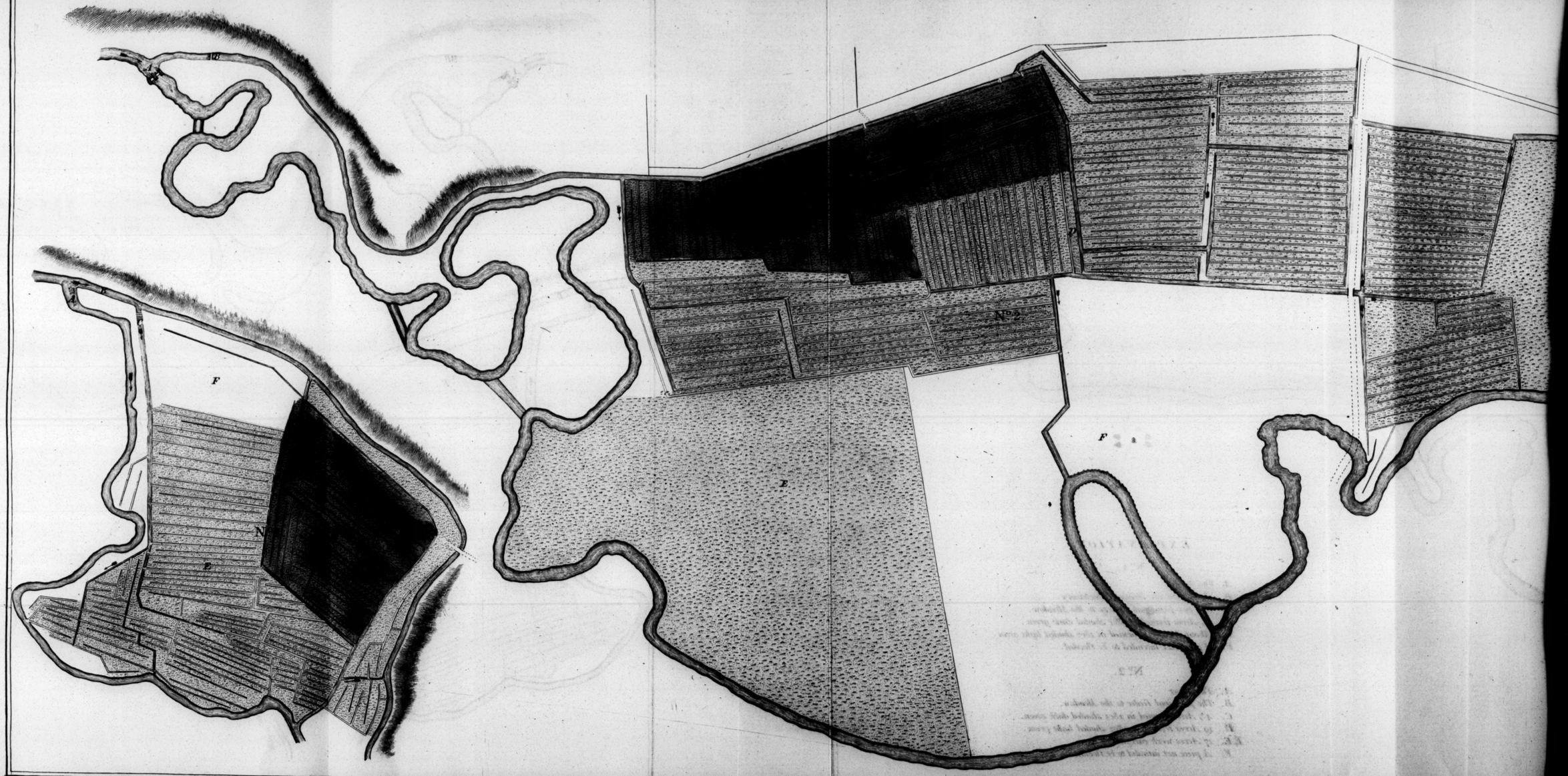
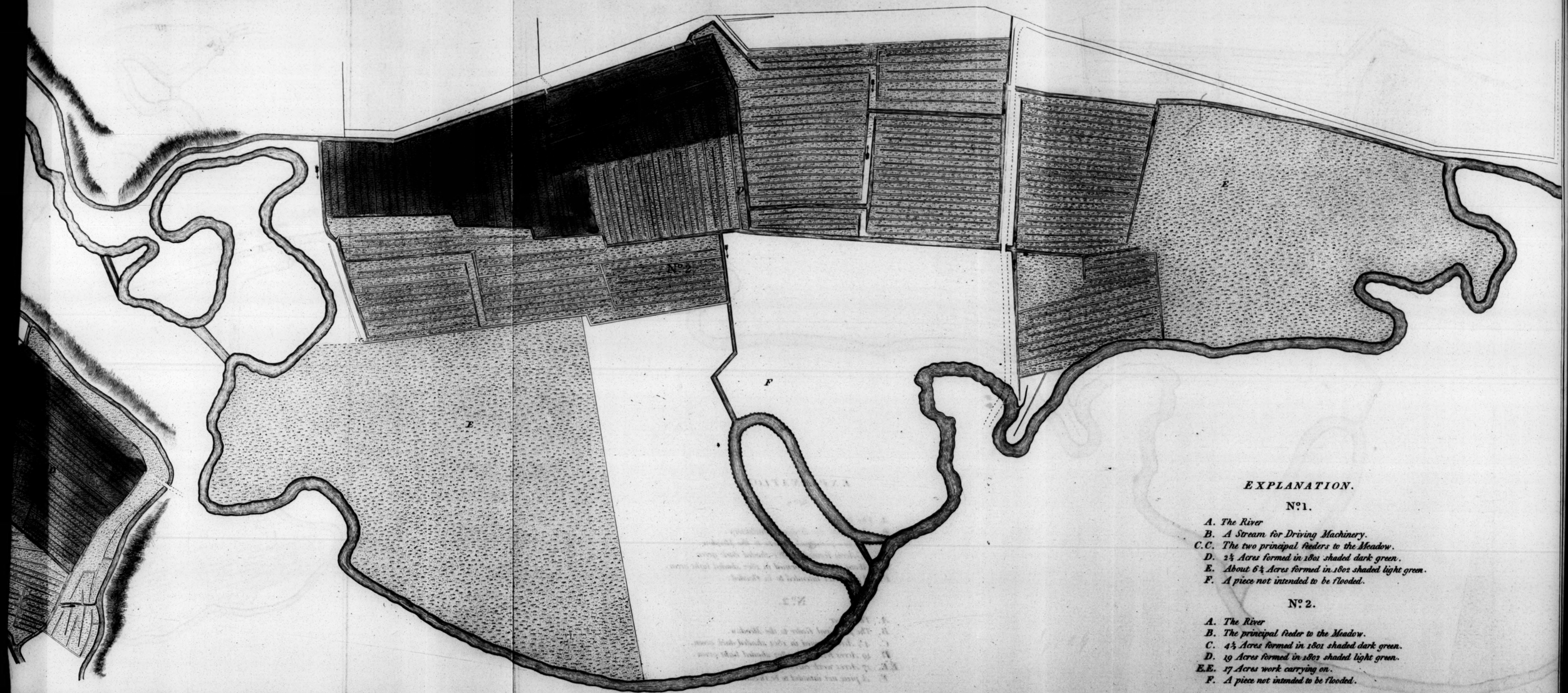

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Plate I.



EXPLANATION.

Nº1.

A. The River
B. A Stream for Driving Machinery.
C.C. The two principal feeders to the Meadow.
D. 2¾ Acres formed in 1801 shaded dark green.
E. About 6¾ Acres formed in 1802 shaded light green.
F. A piece not intended to be flooded.

Nº 2.

A. The River
B. The principal feeder to the Meadow.
C. 4½ Acres formed in 1801 shaded dark green.
D. 19 Acres formed in 1802 shaded light green.
E.E. 17 Acres work carrying on.
F. A piece not intended to be flooded.

No. III.

Claim for Premiums offered for Irrigation.

Board of Agriculture, 1802.

No. 12. *IRRIGATION.*

"To the person who shall, in a country where Irrigation is not generally in practice, water the "greatest number of acres, and in the completest manner,—*the Gold Medal.*

"To the person who shall under similar circumstances, water the next greatest number of acres, "and in the completest manner,—*the Silver Medal.*

Accounts of the old and new state of the land, and its value, and of the method, expence, and produce, verified by certificates, to be laid before the Board, on or before the third Tuesday, in January, 1803.

The same premiums for 1804.

[The above Encouragement, offered by the Honourable the Board of Agriculture, calls forth the following statement, which is humbly submitted to their consideration.]

Scotland, Aberdeensbire, Buchan District, December 1802.

Induced by the known and experienced advantage of irrigation in England, and having an ardent wish to extend improvements of the kind to the North of Scotland, my own property being much adapted, from several local circumstances, for English improvements, and in a particular manner for that of Irrigation, I fixed on two pieces on the banks of a river, from whence a continual supply of water could be obtained, one of which fields, consisting of nine acres, and the other of forty-one acres, to be wholly converted into watered meadow.

For this purpose I have employed a professional floater to lay the same out for me after the form practised in Gloucestershire.

A plan of both fields, with the work accurately laid down, is herewith sent, and the references upon it will so far explain what is here stated.

Of field No. 1, two acres and one half were formed in summer, 1801, and

Of field No. 2, four acres and one half in the same summer.

The remainder of field No. 1, six acres and a half, done in summer, 1802, and

Of field No. 2, about nineteen acres, in the same summer.—The execution of the remainder of this field, about seventeen acres, is proceeding in.

The original expence of laying out field, No. 1, was six pounds four shillings sterling, per acre; and the expence upon it annually is estimated at ten shillings per acre.

Of No. 2, the expence of laying out the whole forty-one acres is reckoned at an average of nine pounds per acre, including the expence of the great feeder, mason, carpenter, and smith's work; and ten shillings annually for keeping, &c.

Field No. 1, for the five years preceding 1801, let annually for ten shillings per acre.

Field No. 2, for the same period, at seven shillings per acre.

The hay crop of the two acres and a half of No. 1, which I used myself, in the summer of 1802, is estimated, including the value of the after-math, at four pounds five shillings; and

Of the four acres and a half of No. 2, in the same summer, at seven pounds ten shillings.

The production of a crop succeeding to the execution of the work can be no standard; but from the thick sward of grass produced by the water, in place of the scanty and thin grass before, there is not a doubt that considerable advantage will accrue from irrigation, even in our northern clime.

State of the two acres and a half of field, No. 1, in the Summer of 1802.

	£.	s.	d.
Value produce of one acre	1	14	0
Interest of £6. 4s. outlay expence,	£0	6	2½
Keeping annually	0	10	0
Old rent, per acre	0	10	0
	1	6	2½
Increased value, per acre	£0	7	9½

No. 2, Summer 1802.

Value produce of one acre	£1	13	4
Interest of £9. outlay expence	£0	9	0
Keeping annually	0	10	0
Old rent, per acre	0	7	0
	1	6	0
Increased value per acre	£0	7	4

December, 1802.

We hereby certify that the whole expence of converting field No. 1, into watered meadow, did not exceed six pounds four shillings sterling, per acre; and considering that the most expensive part of the work upon No. 2 is executed, we estimate the expence of forty-one acres, at nine pounds per acre.

JOHN BOULTON, Floater.

December, 1802.

I hereby certify, that field No. 1, now watered meadow, let annually, the five years preceding 1801, at ten shillings sterling, per acre; and that field No. 2, the same period, on an average annually let for seven shillings per acre.

JAMES MITCHEL.

December, 1802.

The produce of four acres and a half after one winter's floating, the hay crop in 1802, valued at six pounds ten shillings.

Attested by GEORGE PIRIE.
JOHN GALL.

The lattermath grass of the same, let for one pound to George Pirie.

Attested by GEORGE PIRIE.

December, 1802.

The produce of two acres and a half of the north-east division, after one winter's floating, the hay crop in 1802 valued at three pounds fifteen shillings.

Attested by JAMES MITCHELL, Miller.
JOHN GALL.

After-math say ten shillings, for which it was let. JOHN GALL.

December, 1802.

I hereby estimate the annual expence of keeping watered meadows No. 1 and 2, consisting of about fifty acres, at ten shillings per acre.

JOHN BOULTON, Floater.

Edinburgh, January 8th, 1803.

The statement and plan accompanying this letter, were sent by James Ferguson, Esquire, M. P. for Aberdeenshire.

No. IV.

Premium No. 11, *Irrigation; claimed by the Rev.* R. B. CLOUGH, *of Eriviatt,* near Denbigh, North Wales.*

A TENANT at will, with this ⧺ mark, is proud that the Right Honourable the President and Members of the Board of Agriculture have thought proper to open his sealed letter; and he requests they will do him the honour to communicate their determination as to the merits of his improvements upon his farm, as stated and explained by the three maps, and accounts of the expences, and certificate accompanying this, to the Right Honourable the President and Members

Obliged and faithful servant,

R. B. CLOUGH.

An explanation of the three maps presented to the Right Honourable the President, and the others, Members of the Board of Agriculture in London, on or before the 18th of January, 1803, being the third Tuesday in the said month, and the day fixed for the delivery of the same, in order to entitle the claimant to the premium offered by the said Board, for the Irrigation of the greatest number of acres of land in the completest manner.

MAP. No. 1,

Shews the *original* form and state of the farm which has lately been improved by the occupier, who, it is to be observed is only a tenant from year to year. The quantity of clear ground being 205 acres, 3 roods, 23 perches, and the rough 24 acres, 3 roods, 28 perches; total 230 acres, 3 roods, 11 perches.

MAP, No. 2,

Exhibits the same farm in its *present* form and state, having undergone the following improvements, exclusive of the irrigation represented on the map No. 3, as

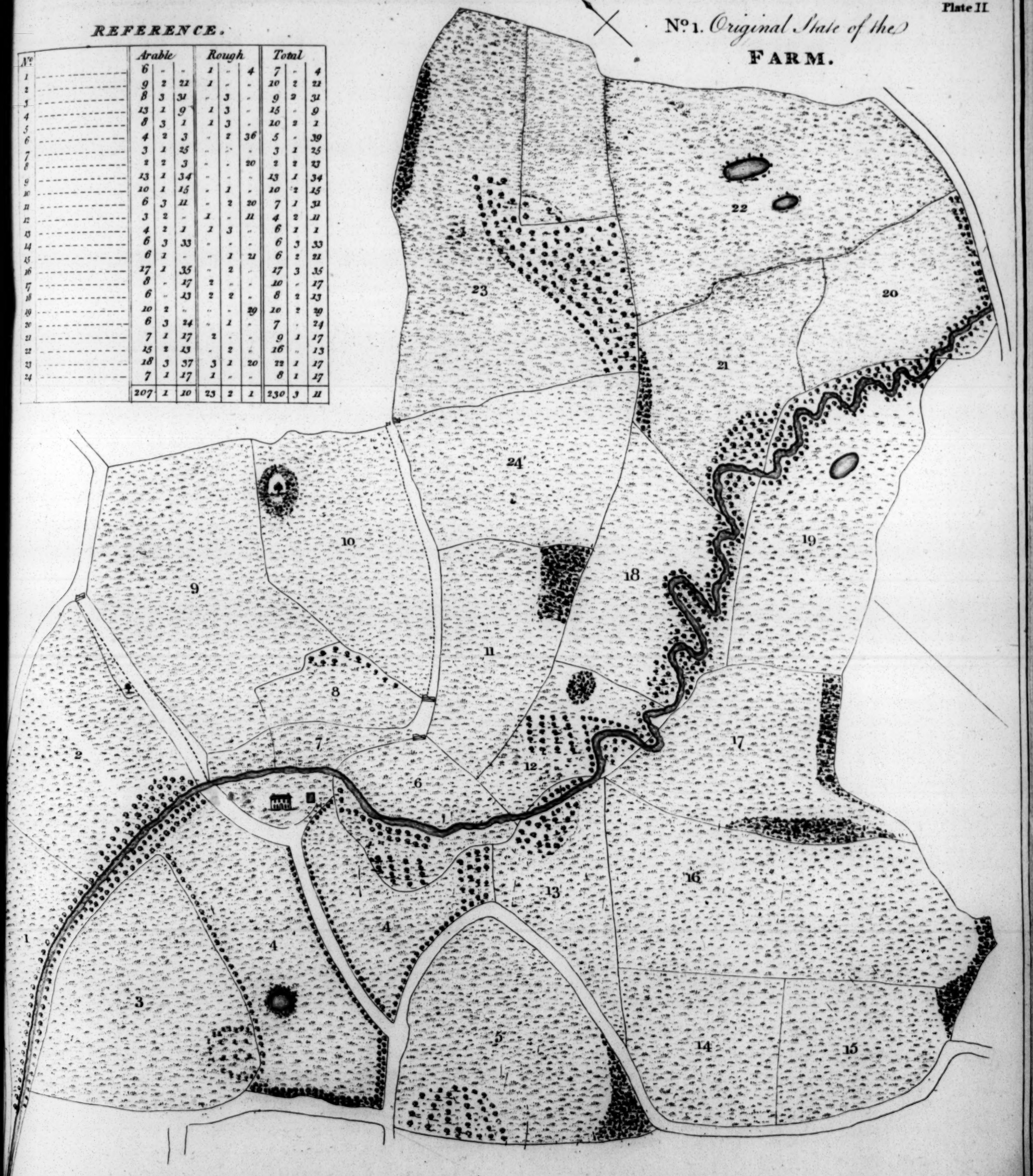
* Which is the farm that has been improved.

Plate II.

REFERENCE.

Nº	Arable			Rough			Total		
1	6	-	-	1	-	4	7	-	4
2	9	2	22	1	-	-	10	2	22
3	8	3	31	-	3	-	9	2	31
4	13	1	9	1	3	-	15	-	9
5	8	3	1	1	3	-	10	2	1
6	4	2	3	-	2	36	5	-	39
7	3	1	25	-	-	-	3	1	25
8	2	2	3	-	-	20	2	2	23
9	13	1	34	-	-	-	13	1	34
10	10	1	15	-	1	-	10	2	15
11	6	3	11	-	2	20	7	1	31
12	3	2	-	1	-	11	4	2	11
13	4	2	1	1	3	-	6	1	1
14	6	3	33	-	-	-	6	3	33
15	6	1	-	-	1	21	6	2	21
16	17	1	35	-	2	-	17	3	35
17	8	-	17	2	-	-	10	-	17
18	6	-	13	2	2	-	8	2	13
19	10	2	-	-	-	29	10	2	29
20	6	3	24	-	1	-	7	-	24
21	7	1	17	2	-	-	9	1	17
22	15	2	13	-	2	-	16	-	13
23	18	3	37	3	1	20	22	1	17
24	7	1	17	1	-	-	8	1	17
	207	1	10	23	2	1	230	3	11

Nº 1. Original State of the FARM.



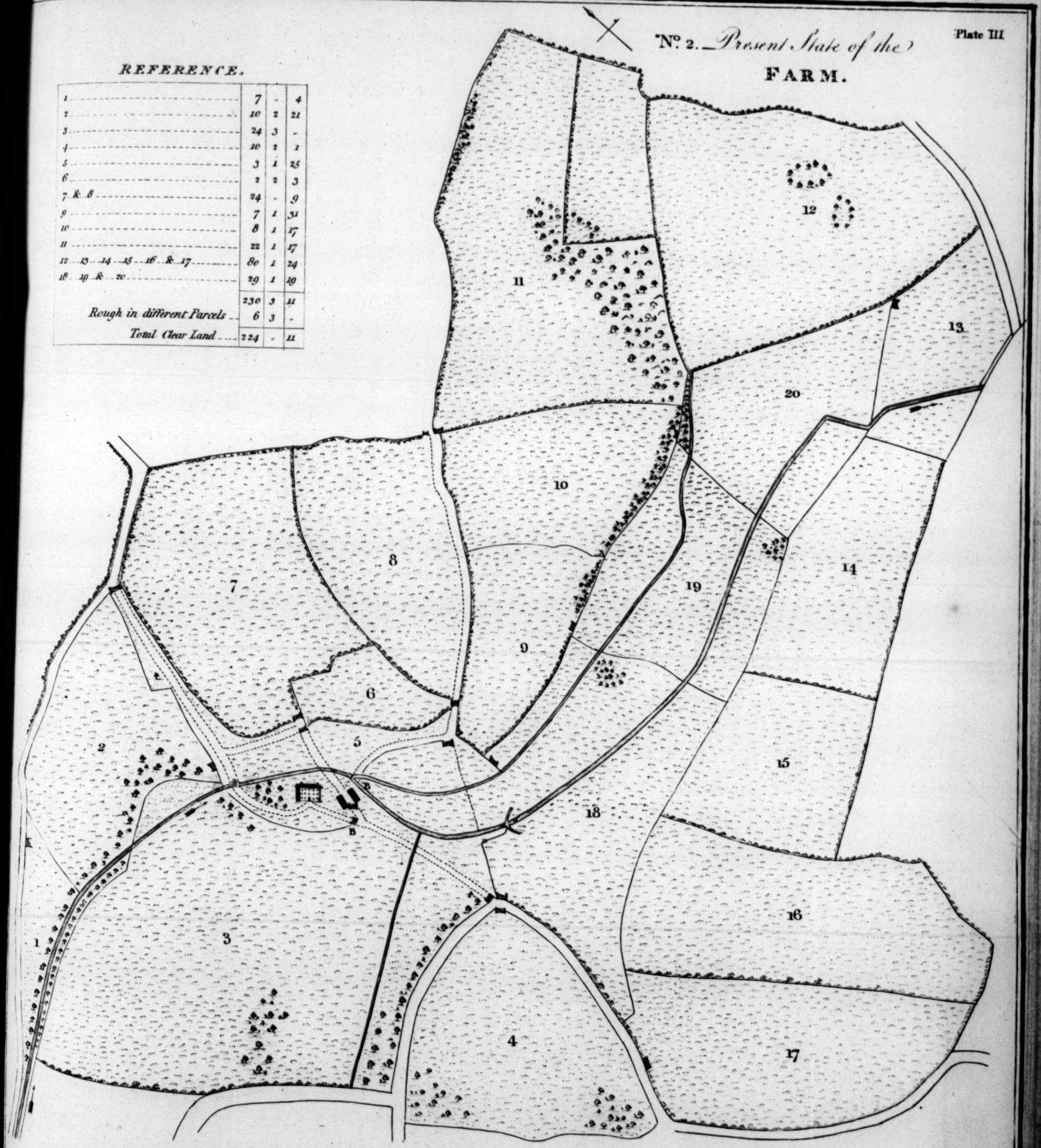
BRITISH MUSEUM

Plate III

N°. 2. Present State of the FARM.

REFERENCE.

1	7	-	4
2	10	2	21
3	24	3	-
4	10	2	1
5	3	1	25
6	2	2	3
7 & 8	24	-	9
9	7	1	31
10	8	1	17
11	22	1	17
12 13 14 15 16 & 17	80	1	24
18 19 & 20	29	1	10
	230	3	11
Rough in different Parcels	6	3	-
Total Clear Land	224	-	11



Neele sculp. 350 Strand.

Plate IV

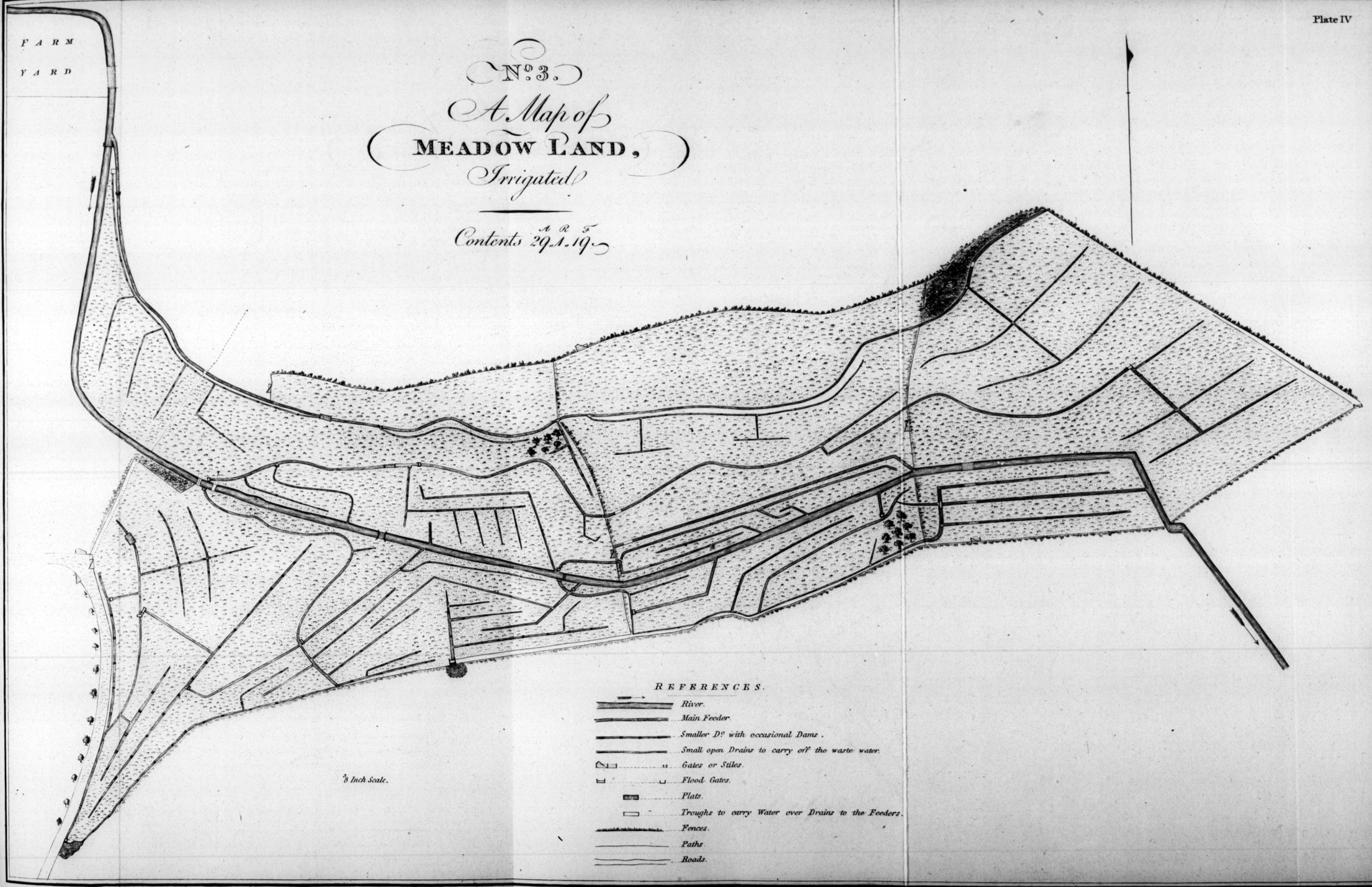
FARM

YARD

No. 3.

A Map of MEADOW LAND, Irrigated

Contents 29 A. 1 R. 19 P.



3 Inch Scale.

REFERENCES.

- River.
- Main Feeder.
- Smaller Dº with occasional Dams.
- Small open Drains to carry off the waste water.
- Gates or Stiles.
- Flood Gates.
- Plats.
- Troughs to carry Water over Drains to the Feeders.
- Fences.
- Paths.
- Roads.

may be observed upon comparing the two maps together, as far as respects the alteration of the fences, and clearing of rough ground, &c. &c. viz.

	£.	s.	d.
To 66 Roods (8 yards) of new road, 4 yards wide, from gate marked A to the house and farm-yard at B, and round ditto to join the farm-yard again at C, at 12*s.* 6*d.* per rood, - -	41	5	0
To 35 roods of ditto, C of ditto, at 3*s.* - - -	5	5	0
To 8 roods of sunk fence round the court, with stone wall, at 21*s.*	8	8	0
To 15 roods of stone wall, set with mortar, 4 feet high, and planted at top with double rows of quicksets, and taking down the old hedge to the garden and rick-yard, at 18*s.* 6*d.* - -	13	17	6
To 226 roods of new fencing, double ditched, and planted with double rows of quicksets, and taking old crooked fences down, &c. at 5*s.*	56	12	6
To 22 roods of open large drains through very hard and shaly ground, in various parts of the farm, at 2*s.* 6*d.* - - -	2	15	0
To 869 roods of under draining, piped with lime-stone, some 5 and 6 feet deep, and others 2 feet only, averaging upon the whole full 3 feet deep, and two ditto wide, at 4*s.* per rood, - -	173	16	0
To one arch over the rivulet - - - £2 2 0			
And 7 plats under gateways, at 13*s.* - - 4 11 0			
	6	13	0
Total - - -	£308	12	0

N. B. Several acres of land cleared, and new pools made.

MAP, No. 3,

Shews the three meadows, containing 29 acres, 1 rood, 19 perches, in their present complete state of irrigation; and the following are the expences that attended the execution of the work: viz.

	£.	s.	d.
To clearing the brushwood on the above, at 20*s.* per acre, -	29	0	0
To 443 roods of under draining, piped with lime-stones, as described in Map, No. 2, at 4*s.* per rood, - - - -	88	12	0
Carried forward -	£117	12	0

	Brought over -	£117	12 0
To 147 roods of new fencing, double ditched, and double rows of quicksets, at 5*s*. - - - - - -		36	15 0
To levelling the above, being extremely uneven, and lowering several shaly banks to fill up hollows, and covering the same with good soil; and levelling and making 728 roods of feeders, and 215 ditto of open drains, and puddling and watering the same in the completest manner, at £11. 10*s*. per acre, - -		333	10 0
To 16 plats worked with lime stones, and covered with strong flags of ditto, at 10*s*. 6*d*. each, - - - - -		8	8 0
To one arch of ditto, over the rivulet, - - - -		1	15 0
To seven large double flood-gates, set in brick, stone, and Aberdovy mortar, which hardens and sets well in water, at £1. 10*s*. each		10	10 0
To 25 smaller ditto, ditto, at 15*s*. each, - - -		18	15 0
To 2 wears across the rivulet, at 15*s*. - - - -		1	10 0
To irrigators' board and lodging, and the keep of a horse for one year		31	10 0
Total - - -	£	560	5 0

N. B. The labourers in this work, as well as in the general improvement of the farm had, besides their wages, what we call wetting or supping, which is either milk or broth, two meals every day, and it cannot be worth less than two-pence for each man per day.

☞ The lime-stone quarry, from whence the stones were carried, is two miles and a half distant from the premises in question, which has enhanced the charges considerably, each cart load being worth at least 2*s*. 6*d*. delivered on the spot.

Irrigation of 29 acres, 1 rood, 19 perches.

We the undersigned, neighbours of the occupier of the farm, two maps whereof, in its *original* and *present* state, together with a third, shewing a plan of the improvements made thereon by the draining and irrigation, finished in the course of the year 1801 and the first fortnight of the year 1802, of three meadows containing 29 acres, 1 rood, 19 perches, part thereof, annexed hereto, do hereby, voluntarily and without any fear, favour, or affection, certify that we were well

acquainted with the said premises before the improvements were begun, and do verily believe that they were not upon an average worth more than six shillings per acre, per annum. We have also perused and examined the foregoing statements of the particulars of the improvements upon the farm in general, as well as the three meadows in particular,

The expence of the former being	-	£308	12 0
And of the latter -	-	560	5 0
Total	- -	£868	17 0

And do hereby further testify that they are correct and true, and that the 29 acres, 1 rood, 19 perches, so improved, produce upon an average full one ton and a quarter of hay, per acre, per annum, which in this neighbourhood would at all times sell for £3. or £4. per ton, but now for much more. And we do adjudge that the said meadow land is well worth to a farmer, exclusive of all taxes whatever, which are now excessively high, full £2. 15s. per acre, per annum, and if let to the inhabitants of the next market town (two miles and a half distant), would fetch, at least, £3. 10s. if not more. We further believe that the premises are the third that have been so improved, and completed in this county, at least of any magnitude, and are most assuredly upon a much larger scale than any within our knowledge, and perhaps the most expensive too, though necessarily so from the great unevenness and hardness of the ground in the dry banks, and the numerous springs, and swampyness of the hollow and flat parts, together with the difficulty of grubbing up the numberless stumps about, and filling up the old bed of the river, which was before very crooked. We are fully persuaded also that the benefits that will be derived from the example of this work to this neighbourhood will be very great, as we ourselves, upon our respective farms, as well as many others within our knowledge, have been tempted to do a little, being fully convinced of the advantage of flooding lands from the proof of this work, which is daily before our eyes. We further know that the above work was planned by, and executed under, the directions of a person from Gloucestershire, a great distance from us, which was no trifling addition to the expence above stated. The benefits that this farm will gain by this improvement are astonishing, as it had no hay ground before that would produce a ton per acre, without being well manured every third year, which

would require almost all the dung made in the farm-yard in the course of the year; whereas now, the watered land will bring annually into the farm-yard from thirty to forty tons of hay, and not requiring any the smallest return from it, the whole of the manure arising from the same may be applied in raising turnips, to be fed on the pasture ground, or otherwise applied in compost, &c. for the arable land, and in a few years, as the crops must in consequence naturally increase, the whole farm will become proportionably of greater value. We beg leave further to add, with respect to the farm in general, that in consequence of the great expence of altering and repairing the fences, the buying of vast quantities of hay, straw, and manure, from the next market town, and the complete good management thereof, that the said occupier has improved the said farm, moderately speaking, full one-third in annual value. In witness whereof we have hereto set our hands, this 14th day of January, 1803.

JOHN WILLIAMS,
EVAN EVANS,
JOHN HUGHES,
} Farmers and neighbours of the Occupier of the premises irrigated.

The occupier of the farm and premises in question, who, as was before observed is only *tenant at will*, has presumed to offer the plan of the lands he finished draining and irrigating, the beginning of last year, to the inspection and consideration of the Right Honourable the President and Members of the Board of Agriculture, hoping that they may be approved and thought deserving of the premium No. 11, offered by them to the person who shall, in a country where irrigation is not generally in practice, water the greatest number of acres, and in the completest manner. The said occupier has likewise taken the liberty to send, for the examination of the Right Honourable the President and Members of the Board of Agriculture, the maps of his farm in its *original* and *present* state, hoping the improvements made thereon, may at least meet with their approbation, if not merit some reward. To deserve, and receive, so honourable a distinction, would be highly gratifying to him, and with a strong inclination to be of service in his neighbourhood, and promote the general interests of Agriculture, would also be an additional incitement to future exertions.

It is humbly hoped by the said occupier, that any incorrectness in the maps, or want of due form in the statements, and certificate, signed by three of the largest farmers in this neighbourhood, each of whom occupies about £200. per annum, may be looked at favourably, as this is the first claim he has ever sent in to the Board, and is, of course, a perfect stranger to any set forms that may probably be required. Should any further explanation be deemed necessary, the occupier would be very willing to afford it, if the Board should think fit to open his sealed letter accompanying this, to know his address, and require it, as he can pass his word of honour for the truth of what has been stated. The said occupier is fearful also, that it is necessary to apologize for the manner in which the plan of the watered ground is executed, and can only plead as his excuse, that it is the first attempt of the surveyor's, and has cost him immense time and trouble, but it is believed to be quite correct, as to the quantity and form of the work. The maps of the farm in its *original* and *present* state, have been copied from an old survey, and may therefore, possibly, have some inaccuracies in them. In the latter, the fences taken down are omitted, and the new ones inserted, but the watered land has undergone a fresh survey, and is correct. Having stated every thing that he conceives necessary for the information of the Right Honourable the President, and the Members of the Board of Agriculture, to enable them to determine on the merits of his improvements, he takes leave to offer his sincere good wishes for the prosperity of the Board, and the general interests of Agriculture, and has the honour of subscribing himself their most obedient servant,

A FRIEND,

With this  Mark.

No. V.

Premium No. 12, *Irrigation*; *claimed by* EDWARD PEARSON.

I DO hereby certify, that the meadow floated by Edward Pearson, according to the annexed plan, was valued by me at twenty shillings per acre, in the year 1803; and I have this day looked over the same meadow, and owing to the improvement made thereon by watering it, I think it now well worth thirty shillings per acre; which improvement has been made by Edward Pearson since the 2d day of February last.

Witness my hand this 25th day of January, 1804,

WALTER JONES,
Agent to Sir R. W. Vaughan, Bart.

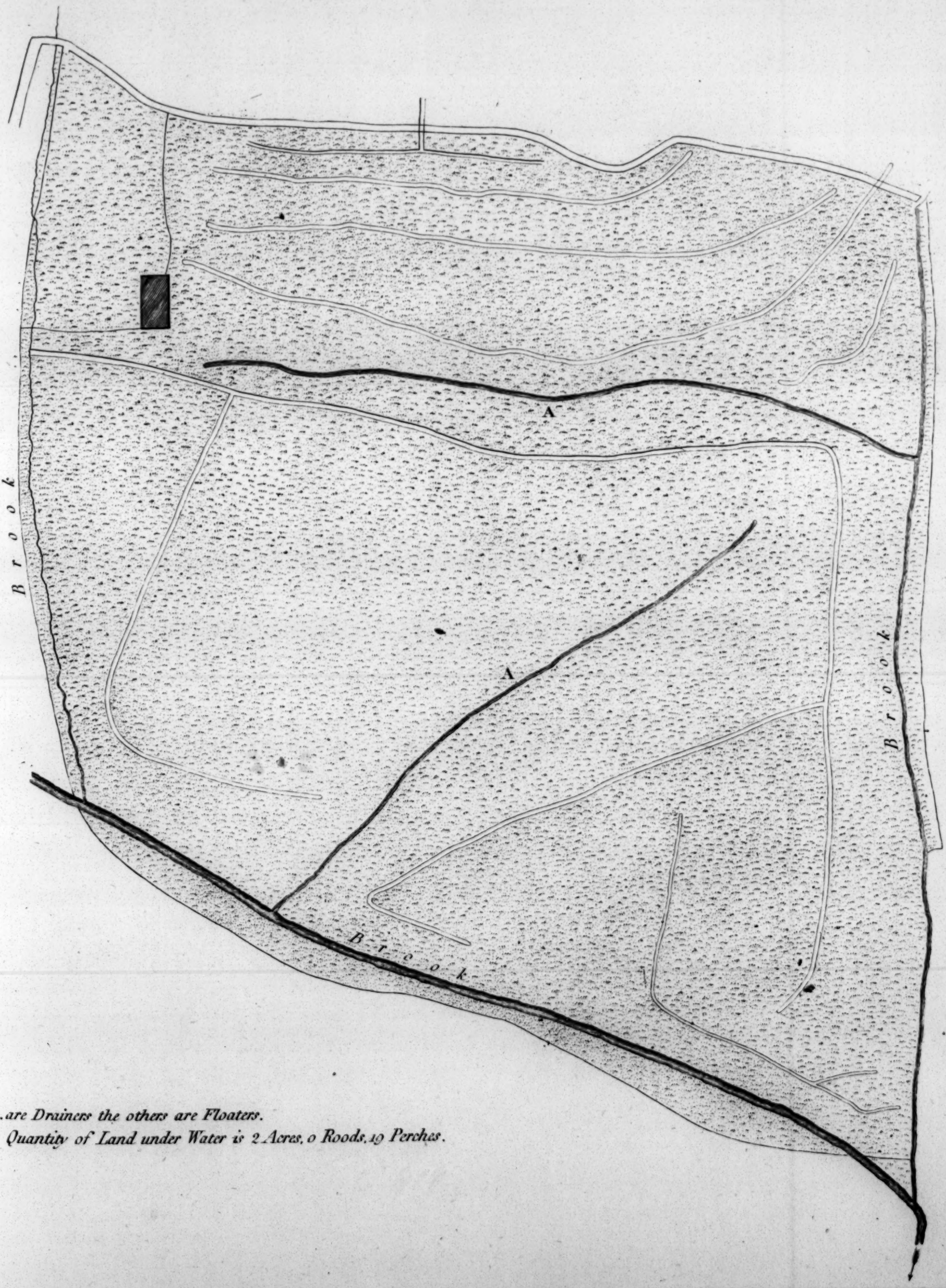
To the Honourable the Board of Agriculture.

I am butler to Sir Robert Williames Vaughan, Bart. of Namau, in the county of Merioneth, North Wales; the farm is called Tyddyn Buck, in the parish of Llanfachreth.

EDWARD PEARSON.

23d January, 1804.

Plate V



A.A. *are Drainers the others are Floaters.*
Quantity of Land under Water is 2 Acres, 0 Roods, 19 Perches.

Neele sculp. 352. Strand



No. VI.

List of Seeds from Sumatra, *&c. sent by Dr.* Campbell, *of Fort* Marlborough, *to the Right Honourable* Lord Carrington, P. B. A.

My Lord,

I had the honour of addressing your Lordship, by the Culland Grove, tendering my best acknowledgments to the Board of Agriculture for the approbation and distinction they have so liberally bestowed on my labours. I now forward such seeds as the season yields, and request, as an accident hinders me from preparing a separate collection for his Majesty's gardens, that a portion of them may be sent to Mr. Aiton, the Superintendant, to whom I have written on the subject; a few, more remarkable for beauty than utility, are put up exclusively for this purpose.

I shall be happy in receiving your Lordship's future commands; and have the honour to be,

My Lord,

Your Lordship's most obedient servant,

Marlborough, March 20, 1802. D. CAMPBELL.

List of Seeds, &c.

Benzoe, the tree yielding the Benzoin resin.

This will be a splendid acquisition to the West Indies. Its favourite soil is the slope of clayey mountains, close upon running streams: the kind, of which I send the seeds, is that so much in request in commerce. It is not a *styrax*, as botanists have described it: its history is to be found in Marsden's Sumatra, fol. p. 124.

Copal.

This non-descript tree, with winged seeds, yields a most pure resin, much resembling the copal of a high odour. It is found on the banks of rivers much inland; I have not seen the flowers.

Cardamom (the roots). The true round Cardamom of Sumatra.

This is the *Amomum Cardamomum* of Linneus: the *Cardamom Minus* of Rhumphius, *Herb Amboin.* Vol. V. Tab. 65, and well delineated by Gort. in his Cat. Vol. I. Tab. XII. under the name of *Zinzeber Minus.*

It is certainly superior in flavour to the small triangular podded kind, but I am uncertain whether it has ever found its way to Europe from these islands, in any quantity. The roots, I hope, will live, for I have had horse radish brought me from England in sand. I have put up two small casks of them, one in sand, and the other in dry clay. Its favourite soil is a sandy clay, much shaded by trees and shrubs.

Saguerus; the cordage palm formerly sent.

I am so anxious about the extensive propagation of this most useful tree, that I have sent a large quantity, about twenty gallons, of the seed.

Dolichos tetragonolobus, Lin.

This excellent, and almost perennial pulse, will be found a very useful and wholesome addition to the diet of the Negroes. The legumes only are eaten, when young and tender: they are cut into slices, and dressed like French beans, which they much resemble in taste.

Dolichos bulbosus, Lin.

I have some reason to think that this pulse is already a native of the West Indies; lest I should be mistaken, I think it right to forward it with the others. It is cultivated for the sake of its roots, which are insipid, and much resembling in size and appearance a small turnip.

Phaseolus max. cadeli, Lin.

This is perhaps one of the most nutritive beans known: it is originally from China, where it is prepared into a kind of transparent paste, and drawn out into long filaments, which are called *loxai*, and forms a chief ingredient in the richest soups of that luxurious people. The Chinese colonists here cultivate it universally. It is frequently eaten without any farther preparation than simple boiling: the plant is low, hairy, and its produce almost incredible, even in poor land.

Ararrhoa Carambola, Lin. Sweet Bilimbi.

I perceive by Bryan Edward's Catalogue of the *Hortus Eastensis*, that the *Ararrhoa Bilimbi* has been introduced to Jamaica. I hope this much superior

species will also thrive. Its acid is exceedingly refreshing, and when the fruit is mellow, by no means so austere as that of the lesser kind; with the juice of this, the Malays give an elegant blue colour to their sword blades.

Oryza montana.

Ten varieties of rice cultivated on highlands, after the manner formerly detailed. I send these not merely as matter of curiosity; they are selected from mountainous parts, in different temperatures, from the vicinity of the sea to the great range of hills which divide this island, so as to give a probability of some of them flourishing in the different regions to which they may be destined. Their Malay denominations are marked in the list which accompanies.

Bassia latifolia, Lin.

A species of apple, rather of a pleasant flavour.

Cassia sumatriana.

A species of ebony, swift of growth, and rather a pretty tree; as yet little known.

These are all of the useful sort now to be procured: I have to regret that the period at which the Indiamen arrive on this coast is not favourable for their communication. Our great harvest is towards the close of the year; and, as I have already remarked, the seeds of our finest fruits are exceedingly tender, and will not keep for any length of time. I now add a few seeds of our more elegant flower trees, in which the Malay isles abound, and which surpass in fragrance any productions of the western hemisphere.

Michelia champasa, Lin.

With long yellow flowers, highly odorous; a middle sized tree.

Uraria tanango, Lin.

With pendant flowers, the petals green. This affords the highest perfume of our groves: from the flowers an essential oil is distilled, much in use among the Malay damsels.

Minusops tangong, Lin.

With stellated flowers worn in garlands in the hair; the odour rather powerful.

Uraria zeylumia, Lin.

This is not fragrant, but its large rasureous flowers are pretty, and the fruit, which clusters somewhat like the grape, is eaten. It is subacid, and sweetish.

Signed, D. CAMPBELL.

List of the Packages for the Board of Agriculture.

One small keg, No. 1. *Phaseolus max.*

One ditto ditto, 2. *Dolichos tetragonolobus.*

One somewhat larger 3. Containing roots of the true Cardamom in earth.

One ditto ditto, 4. Containing ditto, in sand.

The kegs of mountain rice in the sheaf.

No. 5. Called by the Malays *Poolit* or *Pooliot itam*, with a purple grain, the colour of which, however, is confined to the outside.

6. *Poolit Bamban.*

7. *Poolit Gadding*, or wavy coloured paddy.

8. *Kassoombar*, or *Arrotto* coloured paddy.

N. B. All the above kinds are of a very glutinous nature, and boil soft; these undermentioned are hard grained, and preferred for common food; the glutinous kind being chiefly used in making cakes and sweetmeats.

9. *Paddy Panden.*

This rice, when newly cut and boiled, has a high odour resembling the flower of the Panden, and is in much esteem.

10. *Paddy Rooning.*

Rices with a yellowish husk, in great request.

11. *Paddy Bobee,*

12. *Paddy Pootee.*

13. *Paddy de Tonkaye.*

14. *Paddy Deree Argen.*

All strong common hardy rice, in daily use among the natives, but possessing no peculiar characteristics.

All these severally propagate their kinds, and never run into each other, preserving their individual characters for ages, although growing in the same field. Numerous as these varieties seem, there are upwards of thirty more, though not now in season.

15. Twenty-three gallons of *Saguer Palm* seed.

I cannot sufficiently insist on the advantages which will result from its general culture.

No. 16. To these I add another variety of rice, cultivated in low and swampy land; it is distinguished from the mountain kinds by its *arista*, or beard. The natives avail themselves of this, in parts of the country which are much infested by the rice bird, (*Zoxia Aryzirora*,) which will not touch this kind, deterred by the sharpness of the beards.

N. B. A considerable quantity of *Ejov*, the material produced by the *Saguerus*, or palm, yielding sugar, and the staple for the strongest cordage in the East, is sent in the Fame, to the Honourable Court of Directors, with a view to ascertain the use to which it may be put. The result of such experiments will determine respecting the propriety of cultivating the seeds now forwarded for the West Indies."

The earliest moment was taken by the Board for dispatching these seeds to the West Indies.

No. VII.

On the Introduction of the Teak Tree into Barbadoes.—By Nath. Lucas, *Esq. of Lynxford Hall, Norfolk.*

Tektona grandis, Linn. *Suppl.* p. 151.
Hort. Malabar, IV. 57. Tab. XXVII.

In May or June, 1799, being in Barbadoes, I received sundry East India seeds from Langford Millington, Esq. a Member of this Board, requesting me, by desire of the Board, to distribute them in the Island. No time was lost in so doing: but not a single seed of any kind vegetated, except one of the teak wood; and that was at Sunbury, an estate belonging to John Henry Barrow, Esq. of Hill Park, in the county of Kent.

The soil in which this single seed vegetated is a very rich black mould, upon white clay, in the orchard, north of the dwelling house.

Being again in the Island in July, 1803, I visited the tree, in company with Mr. Barrow, and was astonished to see what progress it had made in so short a period of time. From a memorandum in writing, taken on the spot, under the tree itself, at that time, I found it upwards of twenty five feet high, thriving most luxuriantly, and at least five inches in diameter six feet from the ground. Being an evergreen,

the leaves very large, and the lateral branches very numerous and extensive, it was bowed down very considerably by their weight, and the force of the trade wind, though it was in a sheltered situation. On these accounts, Mr. Barrow was under the necessity of cutting off the lateral branches to keep it more upright: and one of these branches was sent to me, and is now offered to the inspection of the Board, through the favour of A. B. Lawtest, Esq. V. P. L. L. to whom I had given it.

The servant, to whose care its delivery to me was intrusted, most unfortunately barked it before I received it; and being under the necessity of leaving the island immediately, I had not time to procure another specimen.

The length of the branch was considerable; but it was cut short to enable me to convey it with conveniency during the voyage, and my subsequent journey home into Norfolk.

The wood is very compact, small grained, and heavy, as will be noticed in the specimen. Its growth is very rapid, if we consider the texture of the wood: the tree had not flowered when I left the island.

It must prove a most valuable acquisition to the West Indies; particularly in those islands where lands are of little value, and can be suffered to remain encumbered with trees. But it must be valuable in all; for being an evergreen, with very large thick leaves, and a quick grower, it will be planted for ornament. Its use in building the small colony craft will be great indeed; for the property of this timber in resisting the worm renders it invaluable; and its duration in tropical countries is far greater than any other ship timber with which we are acquainted.

The cedar (*Cedrela odorata* of Brown, p. 158,) and the white wood (*Bignonia pentaphylla* of Brown, p. 263,) both of which resist the worm, are now becoming very scarce in Barbadoes, and were almost exclusively used in building the small vessels; even trees originally planted or left for ornament have been cut down.

European oak lasts but few years indeed there; and the *termites* are so fond of it as food, that they can hardly be kept from it by any precautions, if the vessels be laid ashore; and oak timbers laid partly in the water and partly ashore, have frequently been seen eaten by them to the very edge of the water.

No. VIII.

Communications from JOHN CHRISTIAN CURWEN, *Esq.* M. P.

Belle Isle, August 15, 1802.

I HAVE great satisfaction in complying with the wishes of the Board, in transmitting them the rules of the Miners' Society of Workington, and also the amount of the poor rates. Harrington is a separate parish. The account of another work I have not received; they are all however subject to the same regulations.

That I have not made the progress in this institution which might have been expected and hoped for, must be attributed to the prejudices I had to combat in an undertaking entirely new; and, latterly, to the hardships of the times: I look forward with confidence, from the present prospect of things, to induce the people to extend their contributions, and to make comfortable provision for age and misfortunes. I must premise, that the miners are a fluctuating body, and do not look much beyond the present moment; their weekly earnings are from 18*s.* to 25*s.* A discretional power, in extreme cases, is exercised by the committee, and though not sanctioned by rules, has always been approved. I last year proposed a benefit society for cloaths, to be divided at the end of the year, subscribing a third as my share. I hope this may succeed: it is provided that the money can only be applied for cloaths. The subscription 2*d.* per week.

The town of Workington consists of upwards of 7000 souls; 150 sail of vessels belong to the port; and if the expence of militia men, their families, and a hundred per annum, (payable for eighteen years for a poor-house) be deducted, the burthens of the poor will be found light. I do not know of any instance in which my miners have cost the parish a shilling, except in cases of death; to make provision for their families exceeds the present means of my society.

To encourage the people to provide the means of support for themselves, in cases of sickness or misfortune, is highly desirable, both as to the effects it produces in making them more respectable members of society, as well as exempting parishes from the enormous burthens; I have always wished to promote societies, and to enable them to grant every reasonable assistance, which I do not think could be had from their own individual contributions; and to place the conduct and management of this in some measure under their own control. It is considered as dishonourable

to require assistance from a fund belonging to their associates and friends, unless the necessity be real: to avoid being chargeable to a parish creates but little exertion, I fear, at present.

Was a general contribution required from every person, together with a proportionate part from the parish, and any person neglecting or refusing to pay to have no relief but in the poor house, I am sanguine enough to believe very few would subject themselves to what is considered as disgraceful.

I offer what I have done with great diffidence, sensible it is very imperfect, but desirous of showing my respect for the Board; and looking with confidence that, through their exertions, the public may hope for much useful information, and that it may lead to some legislative regulations, beneficial for the labouring poor, and which may also tend to lessen the enormous burdens which are at present so oppressive, and which by no means contribute to render the lower orders either happy or comfortable.

The Workington Society is divided into two clubs; the Bankland, and the Moorbank Colliers, the following is their account.

Abstract of the receipts and disbursements for the relief of the poor of the Township of Workington, as under:

	Collections.			Disbursements.		
	£.	s.	d.	£.	s.	d.
From 1st April, 1792, to 1st April, 1793	604	18	1	501	17	5
to October, 1793	324	1	9	358	12	0½
to October, 1794	637	3	0½	501	11	6
to October, 1795	424	11	1½	475	9	1
to October, 1796	392	15	8½	513	14	0
to October, 1797	549	18	5½	509	8	9½
to October, 1798	574	3	6¾	560	5	5¾
to October, 1799	589	19	2½	691	19	2½
to October, 1800	1005	18	1	903	16	6
to October, 1801	1155	1	8½	992	19	9
	£.6258	10	8¾	£.6059	13	9½
Balance in the hands of Thompson, the overseer,		-		198	17	0
				£6258	10	8¾

The above is taken out of the printed abstracts from Mr. Thompson's account, and agrees therewith. Witness, W. SWINBURN.

Bank-Lands Colliers' Society, Workington.

	Collections. £.	s.	d.	Disbursements. £.	s.	d.
From August 1st, 1796, to 30th December, 1797	72	19	4	26	5	2
to 30th December, 1798	109	10	11	62	14	10
to 31st December, 1799	65	1	6	62	2	5
to 31st December, 1800	56	3	10	81	4	7
to 31st December, 1801	43	16	2	60	9	2
	347	11	9	292	16	2
Money in the hands of J. C. Curwen, Esq. -	-		-	44	10	0
In the hands of the Treasurer - -	-		-	10	5	7½
				347	11	9

Collected from the colliers - -	£.267	7	9
Three-tenths proportion paid by J. C. Curwen, Esq.	80	4	0
	347	11	9

Moorbanks and Chapelbank Collieries, Workington.

	Collections. £.	s.	d.	Payments. £.	s.	d.
1792 -	92	3	3	- 87	19	8
1793 -	87	18	0	- 86	0	4
1794 -	78	13	0	- 79	3	8
1795 -	117	19	6	- 122	12	8
1796 -	121	13	6	- 111	9	2
1797 -	152	1	4	- 141	19	8
1798 -	243	15	10	- 243	5	9
1799 -	247	5	0	- 235	14	9
1800 -	256	5	6	- 286	12	9
1801 -	261	9	3	- 331	0	10
To balance, per Mr. Curwen	66	16	10			
	£1726	1	3	£1726	1	3

	£.	s.	d.
Donations by Mr. and Mrs. Curwen - -	93	1	10
Subscriptions - - - -	1256	3	5
Three-tenths proportion, paid by Mr. Curwen -	376	16	0
Total receipts - -	£1726	1	3

Harrington Colliery,

	Collections. £.	s.	d.	Payments. £.	s.	d.
1793. From 30th October, to 16th Jan. 1794,	38	5	3	6	0	0
1794, to December 24th - -	62	14	6	45	6	7
1795, to December 3d - - -	91	17	0	79	8	0
1797, to July 1st. - - -	99	18	5	72	17	5
1798, to June 1st. - - -	61	5	1	71	4	4
1799, to June 20th. - - -	53	7	3	63	7	0
1800, to June 29th. - -	56	12	4	56	6	11
1801, to June 30th - - - -	49	9	6	101	15	2
Interest received, - -	9	5	5			
1802, to June 12th. - - -	71	15	4	68	2	9
Received, overcharged in July, 1801 - -	5	5	0			
Balance in Mr. L's hands - - -				35	6	8
	£599	14	10	£599	14	10

	£.	s.	d.
Subscriptions - - - - -	£457	9	10
Three-tenths proportion, paid by Mr. Curwen	137	0	0
Error in July, 1801 - - -	5	5	0
	£599	14	10

Rules of the Society of Coal Miners, employed in the Works of J. C. Curwen, *Esq. of* Workington, *in the County of* Cumberland.

INTRODUCTION.

"The Colliers' Society was instituted in the year 1792: the first and principal object it had in view, was to make provision for unfortunate sufferers from accidents which occasionally happen in the works, and which no skill or attention can at all times prevent. It proposed also relief against the common infirmities incident to human nature.

"The establishment of this Society was not, on its commencement, agreeable to many. The founders of it have now the satisfaction of seeing their intentions fully answered: it has proved itself burdensome to none, and a blessing and consolation to numbers.

"Under this impression, the Proprietor, warmly attached to your interest, assures you of his zealous co-operation, and ardent desire to promote, and contribute to any further augmentation which may afford more ample consolation to misfortune, and brighten the conclusion of lives spent in his, and the public service."

The foregoing address was prefixed to the Rules of the Club, in January, 1797; since which period the sanguine hopes then entertained, of extending the advantages of this Institution, have been fully realized, by the Society unanimously and cordially agreeing again to advance their contributions.

The unanimous concurrence of the Society, at the last anniversary meeting, to advance the weekly payments, affords a convincing proof of the utility of the plan, and encourages the most flattering hope, that, excellent as the institution is, it may yet be greatly improved and extended.

By this advance the Society has been able to increase the weekly allowances, which they have proportioned, with much judgment and liberality, to the number in the family, of the member claiming relief.

The allowance to widows of unfortunate sufferers, and of those who have spent a considerable portion of their lives in these works, will (it is trusted) afford a source of considerable comfort to afflicted sufferers, and encouragement to the

industrious to continue in an employ, where their comfort and happiness are considered as an object of the first importance.

It is the cordial wish of the proprietor, that further experience may convince every member of the society, of the wisdom of making a yet more extended provision for age, sickness, and accident. Much may be accomplished by a very small additional contribution.

From the spirit and liberality which have been lately shewn, it would be injustice to the society, to doubt of their making this institution a source of still greater comfort and blessing.

The Committee, to whose judgment and attention much praise is due, will signify to every workman employed (who is not of some other Society) that it will be expected of him, that he will enter into this.

Workington-Hall,
April 12, 1798.

Rules for the Colliers' Society.

The paymaster to be the treasurer.

2. Every member of this society, above the age of fifteen years, shall pay into the hands of the treasurer threepence per week, for the use of the society; and every person, employed in the works, except those who are members of another society, must pay their contribution.

The women and children employed in the works, shall also contribute to this fund. The women, of full age, (of whatever description) to contribute the same as the men; and to have equal benefit with them, under all the rules in which people of that description are comprehended.

The children, whether males or females, whilst they are under the age of ten years, shall contribute one half of the full subscription, viz. three half-pence per week, and shall be entitled, whilst under that age, to half of the benefit to be derived from the fund.

Above ten years of age, and under fifteen, they shall contribute two-thirds of the full subscription, and be entitled to two-thirds of the benefit. Above fifteen years of age they shall be considered as full subscribers; must pay accordingly, and shall be entitled to every privilege comprehended in the following rules, which may be applicable to that class of people.

3. A committee of six persons must be annually chosen by ballot, out of such persons as have been employed in the works for seven years, or upwards. The business of the committee shall be, to examine into the circumstances and condition of members claiming assistance from the fund, on account of sickness. If any doubts arise, with respect to the propriety of the claim, they shall call in the physician, or surgeon, who attends the party, whose certificate shall entitle the patient to the stipulated relief.

4. Strangers employed in the works, shall not be entitled to any relief from the fund, in case of sickness, till six months have expired from their first contribution; unless, by the consent and approbation of the committee, they pay six months contribution to the club, on entry.

5. In cases of casual sickness, and the member having three children, he shall be entitled to seven shillings per week, for the first twelve weeks; four shillings per week, for the next twelve weeks; and three shillings per week afterwards, till able to work. If the member have no children, for the first twelve weeks, seven shillings per week; three shillings and sixpence per week for the next twelve weeks; and three shillings per week after, till able to work,

6. In cases of accident happening to any member, in their actual employment, in or about the works, such member (if unable to work) shall be entitled to seven shillings per week, for the first twelve weeks; four shillings per week, for the next twelve weeks; and three shillings per week after, till able to work. In the above case, where there are three children under the age of ten years, unemployed in the works, eight shillings per week will be allowed for the first twelve weeks; four shillings per week for the next twelve weeks; and three shillings per week after, till able to work. But in case of any very serious accident, the committee may advance the suffering party immediately, the sum of five shillings, over and above the stipulated weekly allowance; to which the treasurer will add five shillings more, on Mr. Curwen's account; to be charged to him, over and above his other contribution.

7. Any member meeting with an accident out of his employment, occasioned by drunkenness, fighting, or any improper conduct, shall not (during his incapacity to work) be entitled to any benefit from the fund.

8. The widow of any member who shall lose his life in the works, shall be

entitled, whilst she continues her widowhood, and has a child under the age of ten years, to forty shillings per annum.

9. The widow of any member who shall lose his life in the works, (having been constantly in the employ for 20 years,) shall be entitled, whilst she continues her widowhood, to forty shillings per annum.

10. In case of the natural death of any member, his widow will be entitled to the sum of five pounds; if no widow, the sum to be paid in equal portions to his children, they defraying thereout the funeral expences. If the deceased member has been twenty years in the works, and the widow can produce a certificate of her being 60 years of age on the death of her husband, she shall be entitled to twenty shillings per annum, during life.

11. In case of the death of any member, by any unfortunate accident in the works, the society shall subscribe six-pence each, extraordinary, to the common fund; and the widow, or surviving children, shall be entitled to receive the sum of ten pounds, she or they, defraying thereout the funeral expences.

12. The agent to retain, and stop the contributions to the club, in his hands, for the use of the society. All persons, quitting the works, to forfeit their benefit in the society. These rules and regulations to be binding to all the members after the first day of May next.

13. Any member, neglecting, or refusing to pay the contribution for three months, unless all arrears are paid up at that time, shall forfeit his benefit and title to the said fund; and can only be admitted again as a stranger, paying up also his former arrears.

14. The society shall advance out of their fund, to the Dispensary established in Workington, the sum of five guineas, annually.

15. The treasurer shall keep an account of all the receipts and disbursements, respecting this society; and shall make minutes, in such account, of all the cases where relief has been given: in which account shall also be described, from time to time, the names of the respective committees, with the description of such cases as may come before him. These accounts to be open for the inspection of the committee, at all reasonable times, when they may require such inspection.

16. The accounts of this Society to be published annually.

Miners' Society, Workington, &c.

Additional Rules for these Societies, as proposed by Mr. Curwen at the end of the year 1802, *viz.*

That from the commencement of the year 1803, the weekly subscription should be advanced to sixpence each.

Moorbanks and Chapelbank Collieries at the end of the year 1802, the collections and payments were as follows:

	£.	s.	d.		£.	s.	d.
Collected - -	200	18	6	Payments	320	1	10
Mr. Curwen paid balance	119	3	4				
	£. 320	1	10		£. 320	1	10

That in consideration of the above proposed advance in the subscription, the weekly allowance to the sick and disabled members, should be advanced from 8*s.* to 12*s.* per week each.

And if such member have more than two children under ten years of age, and not employed in the works, each child above that number to be allowed 1*s.* per week; but in no case this allowance to continue more than twenty-six weeks, or till the member claiming is able to work.

In case of serious accidents, power is given the treasurer, &c. to advance the party or his friends immediately, one guinea.

Every married woman on the birth of a child to have one guinea.

Members paying the above advance, and having been twenty years employed in Mr. Curwen's works without interruption, and continuing their contribution, being disabled from following their employment, to be allowed an annuity of five pounds during their natural lives.

Widows losing their husbands by accidents in the works, for every child under seven years of age to be allowed one guinea, and the widow, during her widowhood, to be allowed an annuity of three guineas.

The common weekly allowances to the sick and disabled members according to the former, and these additional rules, viz. in proportion as 8 is to 12, must be paid

in preference to all annuities and other payments proposed by these rules, which payments and annuities must depend on the then state of the fund, when they are demanded.

On the marriage of any member, who has paid his contribution to this fund for three years before, and who has continued in the works twelve months after, on these conditions he shall be entitled to five guineas.

Women on the like event, according to their contribution, shall have a proportionate allowance on the same conditions.

The above rules not meeting the entire approbation of the society, in order to induce them to adopt them at a future period, and to shew them what benefits they might expect from their being established, Mr. Curwen agreed to pay the additional subscription as proposed, and he has in consequence advanced the real difference of the receipts and payments for the Workington Society for the year 1803, as will appear by the following statement.

Moorbanks and Chapelbank Collieries.

		£.	s.	d.		£.	s.	d.
Year 1803, Dec. 17.	Collected	197	16	1	Payments	477	4	1
Paid by Mr. Curwen	-	279	8	0				
	£.	477	4	1				

Banklands Colliery.

Year 1802.	Collected	38	3	7				
Mr. Curwen's $\frac{3}{10}$ths	- -	7	13	11				
Balance from their own fund	-	2	8	0				
	£.	48	5	6	Payments	48	5	6
1803. Same Colliery.	Collected	24	2	6				
Balance from their own fund, including Mr. Curwen's $\frac{3}{10}$ths		31	19	8				
	£.	56	2	2	Payments	56	2	2

Harrington Colliery.

		£.	s.	d.
Year ending June 22, 1802.	Receipts	55	0	4
Mr. Curwen's $\frac{3}{10}$ths -		16	15	0
		71	15	4
Balance from stock in hand -		2	16	5
	£.	74	11	9

	£.	s.	d.
Payments	74	11	9

Same Colliery.

		£.	s.	d.
Year ending June 15, 1803.	Receipts	56	3	0
Mr. Curwen's $\frac{3}{10}$ths - -		16	16	10
		72	19	10
Balance from stock in hand -		19	16	2
	£.	92	16	0

	£.	s.	d.
Payments	92	16	0

CHARLES UDALE, *Agent.*

On Steaming Potatoes.

My former success in feeding horses with steamed potatoes and cut straw, has encouraged me to attempt to remove the only inconvenience I found attending it, —the length of time and labour requisite to steam any considerable quantity. I consumed last year at this place, and Ewanrigg (where I have works), upwards of 60,000 stone. The washing was an operation of great labour, and if not particularly attended to, was often ill done.

In the plan of the steaming house, which I have the honour of sending to the Board, is a washing machine, which will most completely clean eleven stone in two minutes, and requires only a trifling exertion.

It will give me great satisfaction to find the Board approve the plan. I subjoin the most accurate account I am able to make, of the expence of feeding my work

and carriage horses;—the work horses are employed from eight to ten hours, and, from the nature of their work, are obliged to travel quickly; these horses stood their work remarkably well the last year, and continue to do so at present.

I begun to feed with potatoes the 5th of October: to each horse is given daily one stone and a half of potatoes, mixed with cut straw, in the proportion as one is to ten. The average cost of potatoes 3*d.* per stone, one stone and half, - $4\frac{1}{2}d.$

Oats, at 2*s.* 4*d.* per Winchester bushel, weighing from 39lb. to 40lb.

8lb. of ditto	- - - - - -		6
Hay, at 6*d.* per stone,	7lb. - - - -		3
Cut straw,	4lb. - - - - -		1
Steaming the potatoes	- - - - -		$0\frac{1}{2}$
	Per day -	1*s.*	3

Horses of great draft, and such as cannot be allowed to rest at noon, will require 12lb. of oats, which will make the cost of feed, per day, 1*s.* 6*d.* These horses consume rather less hay, but have double the quantity of cut straw with their oats, (which are bruised,) which makes the expence nearly equal.

The steaming 120 stone of potatoes requires two and a quarter Winchester bushels of coals = 137lb. (the weight of the bushel 61lb.) costs - 0 $6\frac{3}{4}d.$

The labour costs	- - - - -	1	8
		2	$2\frac{3}{4}$
120 stone steaming, at $0\frac{1}{4}d.$	- - - -	2	6
	The difference -	0	$3\frac{1}{4}$

This $3\frac{1}{4}d.$ per day may be applied towards the first cost, and the necessary repairs of the machinery, and will, in seven months, amount to £8 1 $10\frac{1}{2}$.

One acre of potatoes is equal to four of hay, and, under proper management, the ground will be in as good condition for wheat as if it had been under fallow. The potatoe crop will not in general pay the expence, but there will be a considerable saving, in putting in the wheat, compared with a fallow, equal to forty shillings per acre.

I have spared no pains in having the estimate made as accurate as possible; I have taken the price of hay and potatoes on the average of common years. I have seldom, if ever, cut less than 300 acres of grass, and have found that quantity inadequate to my annual consumption; I have always been obliged to purchase hay, and have paid from eight pence to one shilling per stone, besides the expence of carriage, which would make the average cost ten-pence per stone.

I am fully persuaded, that work and farming horses may be fed with potatoes at a much easier rate than with hay. Should the Board wish for any further explanation of the plan, or information in my power, I shall be happy to give it.

Nov. 21st, 1802.

N. B. The waste of potatoes in steaming is about one-eightieth part. Since the following account was given to the Board, straw has been substituted in the place of hay, and the horses have kept their condition and done their work perfectly well.

An Explanation of the Ground Plan of a Potatoe Washing and Steaming House.

A. The well. BB. The conduit which takes the water from the potatoe washing-machine.

C. The frame of the potatoe washer.

D. The circle which the crane moves in, which takes the machine out of the tub when the potatoes are washed, and will empty the potatoes into the back marked E, which is raised from the floor the height of one of the steaming tubs, or will meet the other crane, 2. 2. which will place them on the lead pots, where the potatoes are steamed.

F. The boiler seat.

G. The steam pipe which connects with the lead pots H, where the tubs stand upon whilst steaming.

I. One of the cocks which let off the condensed water.

J. The conduit which takes off the condensed water.

K. The framing and platform where the lead pots stand upon, which should be 10 inches above the floor.

L. The stone troughs in which the potatoes are bruised for use.

Reference to the Section.

No. 1. The washing-machine; the handle goes twice about for the washer's once.

2. The crane and jack which wind up the washer, which disengages from the axle by a jointed notch between the two headstocks, marked A.

3. The water bach, which from the pump is supplied by a spout to fill the boiler; also a shorter spout is applied to fill the tub, which the washing machine runs in. N. B. A plug is in the bottom of the tub to let off the dirty water.

4. The boiler, which is two iron pans screwed together by two flanges; and each pan will hold 40 gallons.

5. The lead pipe leads from the boiler, and conveys the steam to the lead pots, and is one inch and a quarter diameter. N. B. The lead pots are 12 inches diameter, and 9 feet deep, marked H.

6. A brass cock which stops the steam when the tubs are taken off: also two other cocks are applied, one to open from the water bach, marked B, to fill the boiler; and the other to know when the boiler is sufficiently filled with water.

7. A steam valve fixed upon the top of the boiler, about 4lbs. to a square inch.

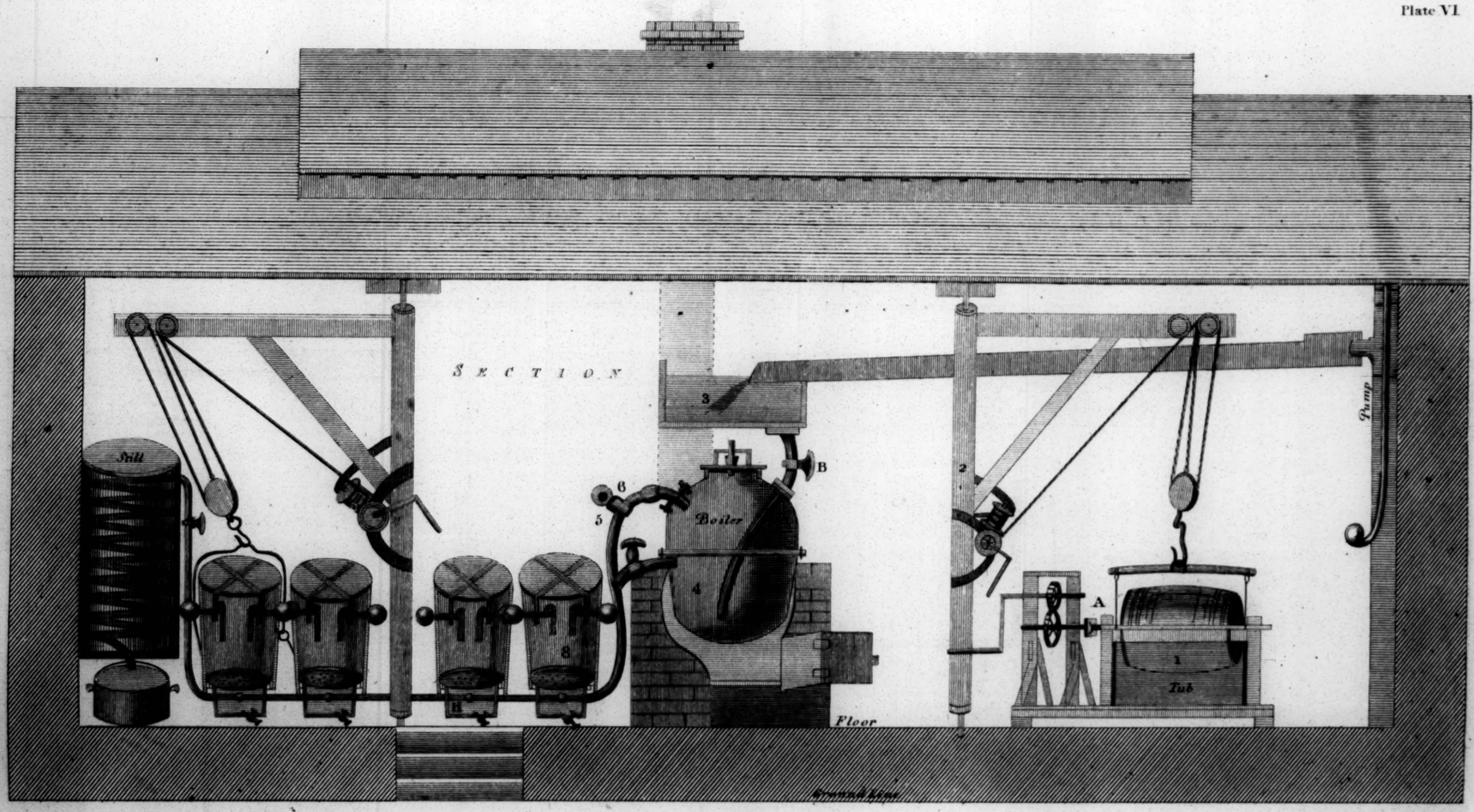
8. The tubs are two feet high, and 20 inches wide at the top, and 17 inches at the bottom, and will hold about eleven stone of potatoes.

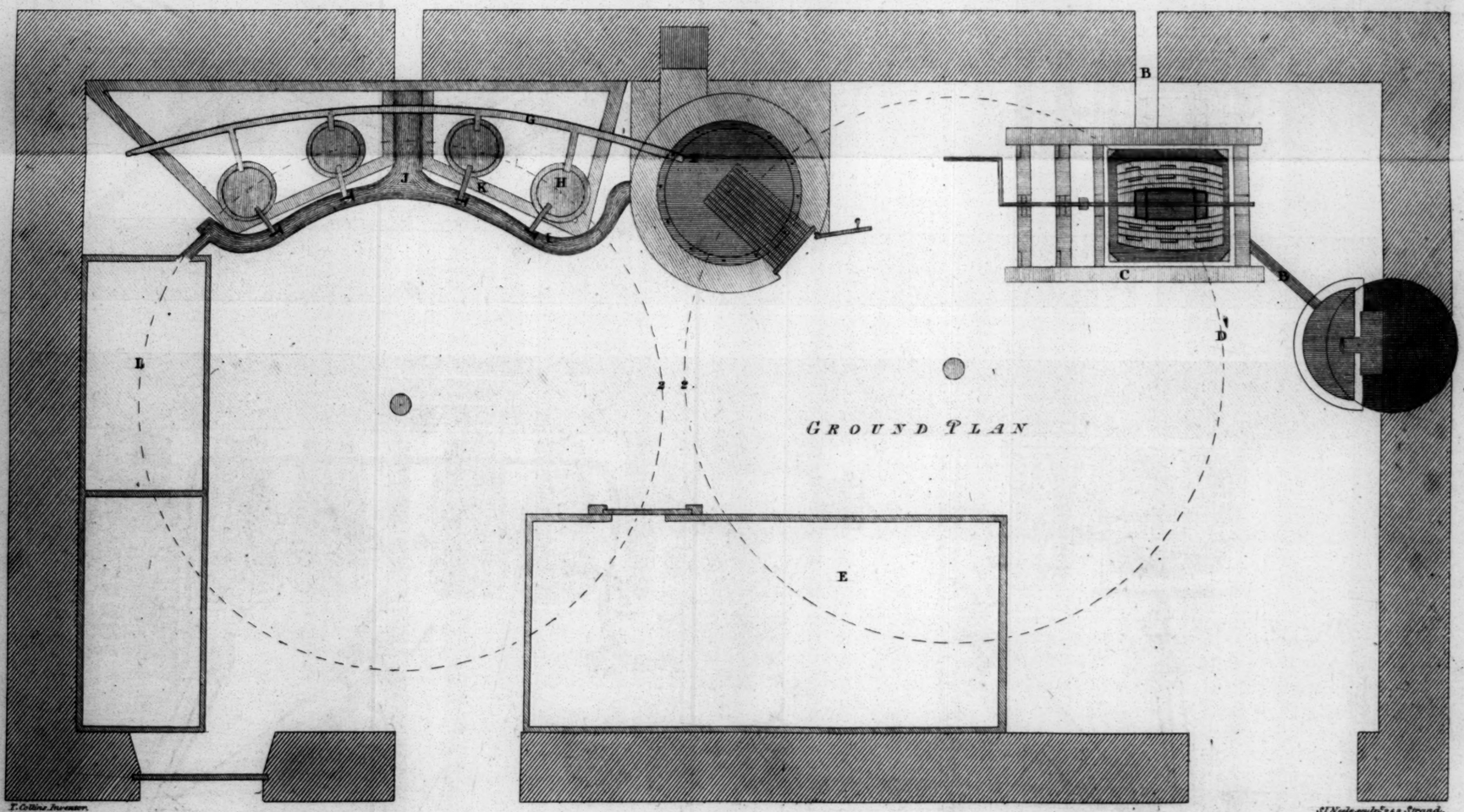
N. B. The boiler will steam the four tubs from fifteen to twenty minutes. One or two tubs may be steamed at a time by plugging up the steam holes in the leaden pots. The tubs set upon the lead pots with flannel between, nailed upon the tub bottoms, and each tub bottom is perforated to let the steam ascend among the potatoes; and the lids of the tubs are holden down by iron ball clevers, four to each tub. When the potatoes are steamed, the other crane removes the potatoes to the stone troughs, to be made use of: and also places the tubs.

Ground Plan & Section of a Potatoe Washing & Steaming House.

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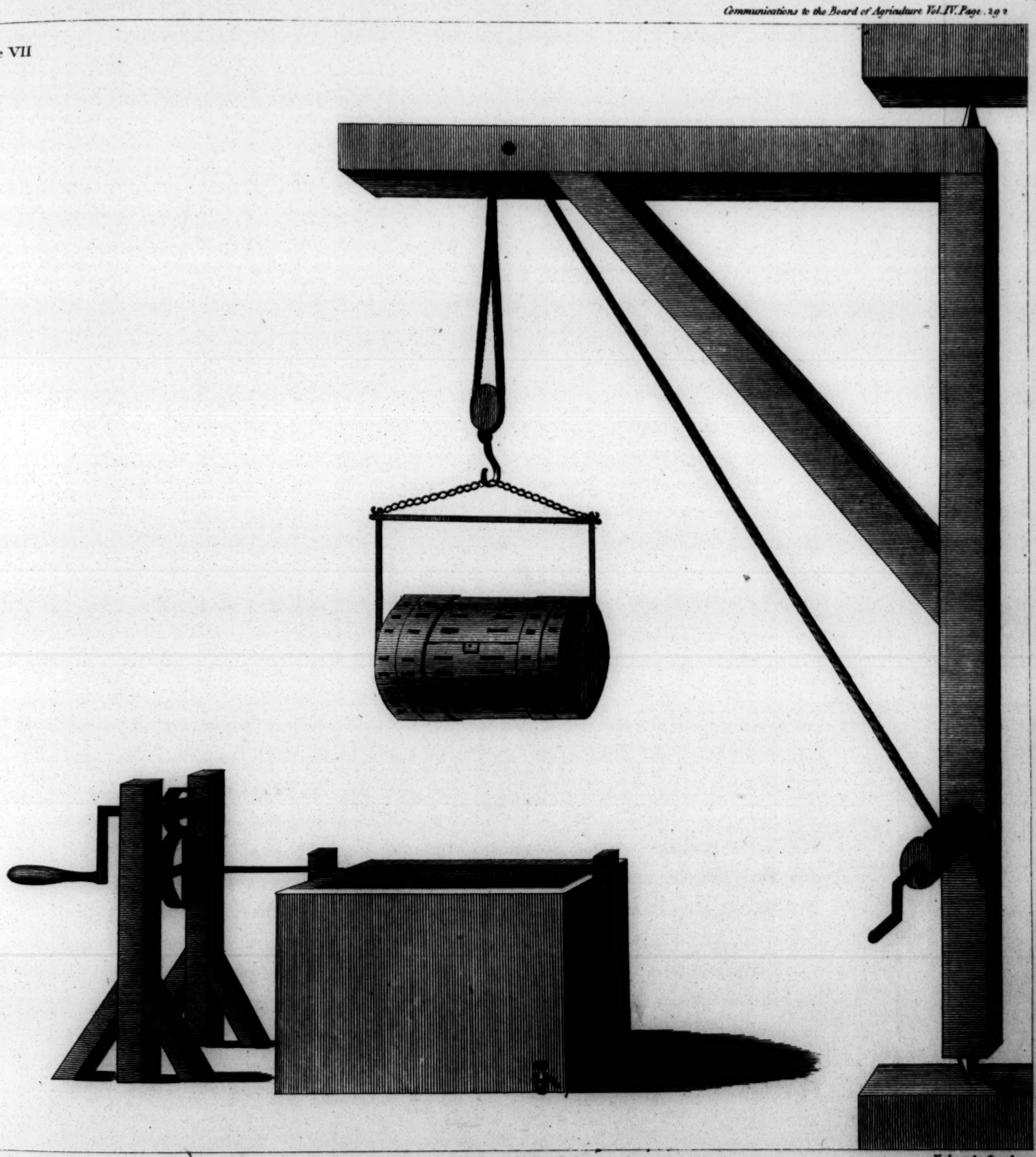
Plate VI






GR III

Plate VII



Neale sculp Strand.

The Washer should be about two thirds filled, it will most compleatly do the Potatoes in two minutes.— When taken out of the Box either pump or throw a pail of water over them, and let it drain thro'.— The size of the Washer must be according to the work required to be done.



Letter from Mr. Curwen.

I wished to have stated to you the result of saving I have found from my present method of feeding my work horses, compared with what it was the year preceding the last. My farm is about 700 acres (I have nearly 100 horses); I estimate it at £1,000. per ann. It sunk seven hundred pounds besides the rent, by the high price of hay and oats, and general ill management. The last year, under my own immediate direction, I have cleared £2,189. and have expended a greater sum upon the farm than in any preceding year. The only favourable circumstance is the reduced price of oats, which, in my consumption may make the difference of £300. per annum.

The accounts pass regularly through my office, that it does not admit even of the allowances which may be sometimes made when persons are strongly prepossessed in favour of any particular system. You will excuse this further trouble; I shall be happy to give any information which may be wished.

Observations by the Bishop of Llandaff on Mr. Curwen's method of Steaming Potatoes.

Workington, Nov. 29, 1802.

I am now with Mr. Curwen, at Workington, and have seen his manner of steaming potatoes, and applying them as a substitute for hay in the feeding of horses: I understand that he has transmitted to the Board of Agriculture an account of his process, and that he is a candidate for a medal. The Committee must be sensible that potatoes have been used, not only as a substitute for hay, but for corn, and, with cut straw, both for hay and corn; notwithstanding this, Mr. Curwen's experiments are, in my opinion, greatly deserving the attention of our Society; they are carried on with the greatest accuracy, and on the most extensive plan, and I can bear witness to the excellency of the machinery with which the progress is conducted; and a saving of labour will be made by Mr. Curwen in a new machine he is about to erect, by the substitution of a wheel to be moved by a rill of water, in turning the machine barrel. I thought Mr. Curwen entitled to this testimony, which may be mentioned to the Committee, but is too unimportant for the consideration of the Board.

No. IX.

On Feeding Sheep.—*By Thomas Estcourt, Esq.*

My Lord, *London, March 29, 1803.*

I have inclosed to your Lordship the result of an experiment on feeding sheep made by the recommendation of the Board; it being one of the annual experiments recommended for trial by the Board to its Members last year. Being in London, attending my duty in Parliament, in November, when the sheep were selected from the flock for trial, there was not so much attention paid to select them of an equal weight, as I could have wished. The sheep were of the South Down breed, or a mixture betwixt the South Down and Wiltshire horned breed: in all other respects the experiment was made, I believe, nearly according to the directions of the Board.

I have the honour to be, &c. &c.

T. ESTCOURT.

Right Hon. Lord Sheffield.

No.	1802.		1803			
	Nov. 22.	Dec. 21.	Jan. 18.	Feb. 14.	Mar. 14.	
1	120	114	113	117	123	Lot I. Fed on turnips and hay in the field where the turnips grew in the usual way: lost 12lbs.
2	151	144	145	148	144	
3	143	135	138	143	147	
4	113	101	100	105	106	
5	145	141	142	136	140	
Total weight	672	635	638	649	660	

No. 6	147	145	153	153	159	Lot II. Fed on turnips and hay, given to them in a grass field, without any shelter: gained 1lb.
7	119	118	115	114	117	
8	118	117	115	116	116	
9	136	137	134	133	137	
10	115	106	108	106	107	
Total weight	635	623	625	622	636	

11	156	154	157	159	164	Lot III. Fed on turnips and hay in a paddock with a shed to retire to at will: gain 4lbs.
12	146	143	146	146	148	
13	Met with an accident, and was killed.					
14	131	125	123	125	128	
15	124	120	120	121	121	
Total weight	557	542	546	551	561	

16	166	166	174	173	167	Lot IV. Fed with turnips and hay in a warm open shed: gained 43lbs.
17	129	121	125	126	131	
18	145	148	153	158	160	
19	136	128	135	137	150	
20	124	117	125	126	135	
Total weight	700	680	712	720	743	

The sheep were all one year old, part rising two, when the experiment began.

No. X.

On baking Potatoes.

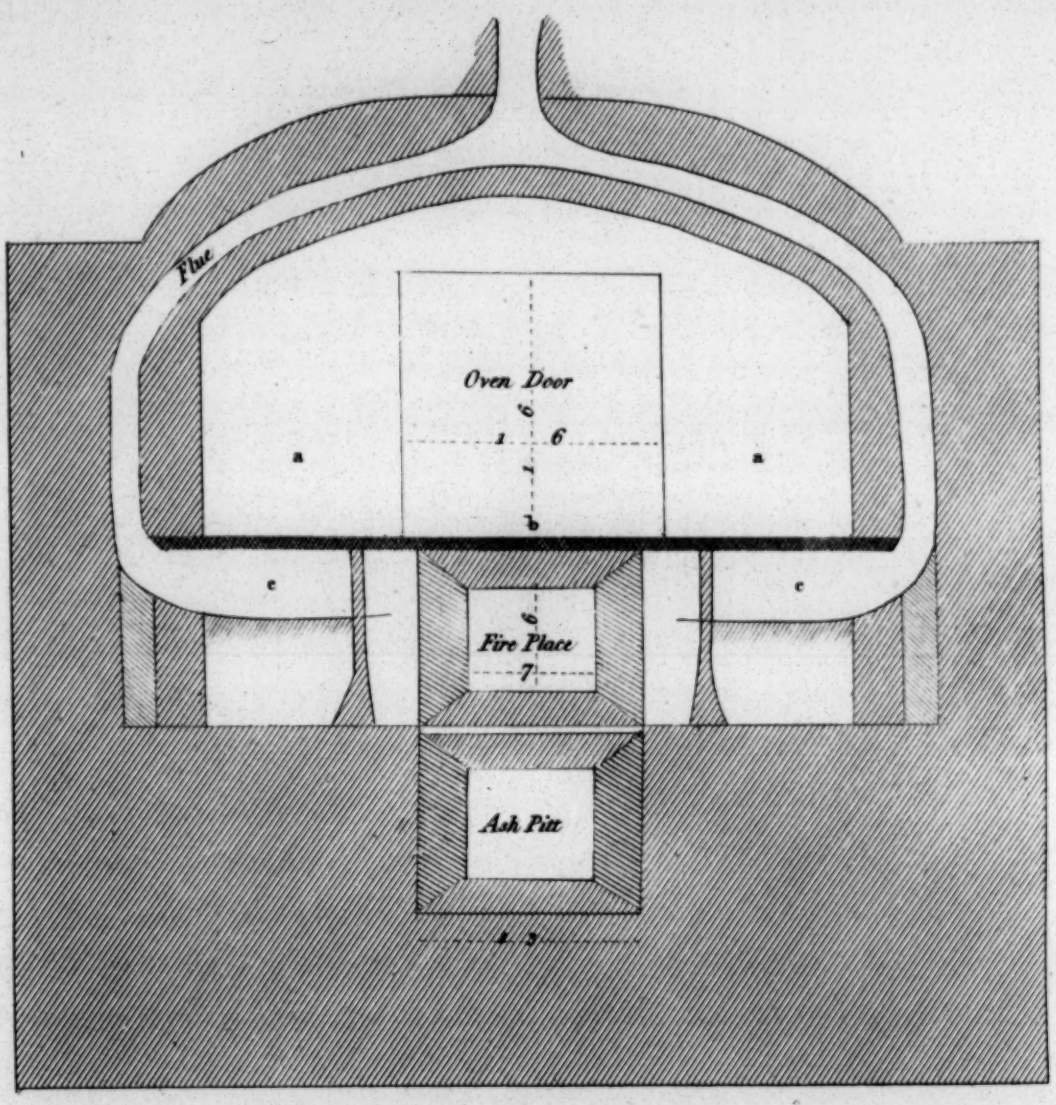
(Copy.) *Letter from Mr.* Pierrepont *to* Charles Taylor, *Esq.*

Sir,

The object of the Society for the Encouragement of Arts, &c. being the general benefit of the community at large, I send you the following method of preparing potatoes for the purpose of both feeding lean, and fattening other stock; conceiving and hoping, from the experiments I have already made, that it will contribute something towards the end which the Society has in view. Not altogether satisfied with the system of curing or preparing potatoes by steam from heated water, which I had practised, and conceiving that some better method might be found out, in 1801 I made several experiments, and bestowed a very great deal of attention and pains before I brought the following plan to bear. I have half a dozen common six gallon digesters, which are filled with potatoes, either fresh washed from the water or dry (for I cannot find that their being in a wet or dry state makes any difference); they are then put into an oven, the bottom of which is a *cast-iron* plate of 3 feet 10 inches long, by 2 feet 10 inches wide; under which is the fire divided into three parts; the middle part or division of which is 18 inches; the other two divisions are 10 inches each: the remaining 8 inches rest upon the brickwork.

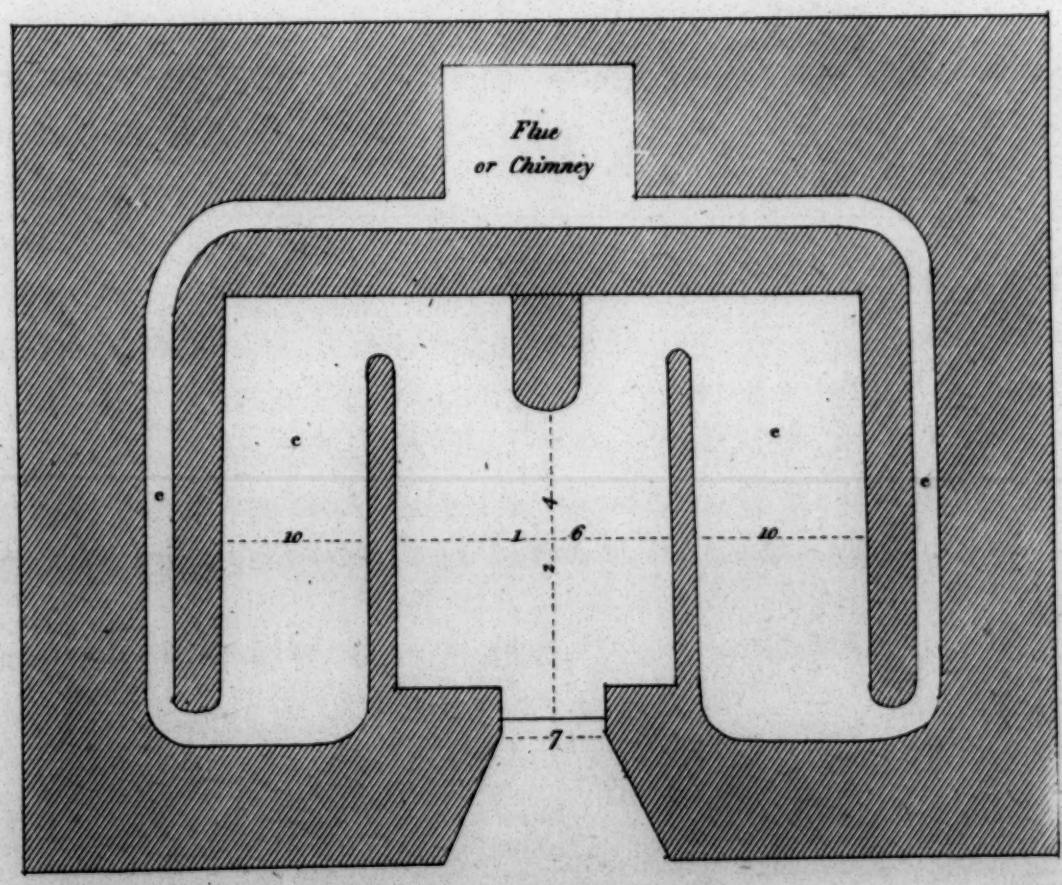
The heat is conducted half one way, and half the other, round the sides of the oven to the mouth, which is nearly 18 inches square, and then over the top uniting in the chimney, in which is placed a damper. There is also an iron rod with a segment of a circle at one end, for the purpose of pushing the digesters into the oven from the mouth, and a hook at the other end to draw them back to the mouth when done. The first round, that is the six digesters, first put into the oven, take about two hours in baking, supposing the fire not kindled before they are put in; and

Plate VIII.



a.a. Oven 3.6 by 2.6 and 1.9 high.
b. A Cast Iron Plate for the bottom.
c.c. The Flues.
The Oven will contain six Digesters.

SECTION of OVEN.



Outside size of Cast Iron Plate 3.10 by 2.10.

SECTION of FIRE-PLACE.

Neele sculp. Strand.

every round after the first may be done in little more than an hour. This process requires very little fuel, and not near the attention, nor by any means the force of steaming, as the potatoes will be done quicker or slower, in proportion to the heat applied, without any of it being lost for want of greater force. Even one round left in the oven over night, with a mere trifle of fuel, will be done the next morning; but I do not allow that to be done, because it turns the potatoes black, and hurts the digesters.*

Potatoes cured this way are not near so apt to turn sour, or scour the cattle; are more dry, so that the animal fed with them drinks a deal more, and they become more hard when cold, so as to be flung to the stock with more convenience, than when steamed. In 1802, I fattened fifteen brace of bucks chiefly with them; I say chiefly, for after the potatoes were gone, they had a few beans. They were very fine, and peculiarly well flavoured. Biggs, at Temple Bar, had thirteen brace of them. I also fattened, the same year with them, two oxen, three cows, and two pigs, which were equally well flavoured, particularly the fat. The pigs had towards the latter end, a few whole peas after each meal. The bucks had six pounds per day each at an average. The lean deer in the parks do very well with little more than a pound per day, instead of hay.

This year, that is within the last seven or eight months, I have fattened two very large oxen, and twenty welch wethers. The wethers, with which there were two South Down rams and one ewe, had eighty pounds of the potatoes per day, with a little cut hay. The ewe was put with them to teach the other sheep to eat them; she has since had twin lambs, and the bailiff acknowledges that the lambs do better than the others at turnips, though he, with some others, dissuaded me from trying more ewes, under the idea that the potatoes would dry up their milk. Four dairy cows never did so well with very good hay, as they did last winter with about four pounds of potatoes, and about five pounds of rubbishy hay and straw cut. But enough on this head. The Earl of Egremont had two of the Welch wethers, and a sirloin of beef from one of the oxen. The other now for sale, on the 22d of March, weighed 343 stone alive, upon a weighing engine: he has had about forty pounds three times a day. I take the liberty of referring to Lord Egremont for the flavour of the meat;

* The digesters must occasionally be rubbed on the insides with a little lard or dripping.

he has seen the process; and I shall request the honour of his Lordship's transmitting this to you, in case he thinks it deserving the Committee's attention.

I am, Sir, your obedient humble servant,

WM. PIERREPONT.

Burton Park,
April 28th, 1803.

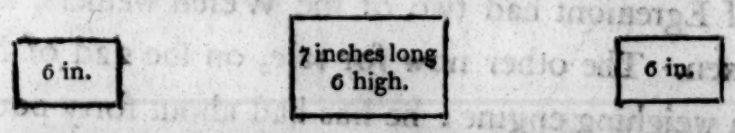
Note by the Earl of Egremont.

I know nothing of the expence of preparing potatoes in this manner, but they appear to me to be more nutritious than in any other mode of dressing, and much better tasted for the table. I did not think it possible to bring such large oxen to such a state of fatness upon potatoes. EGREMONT.

BAKING POTATOES.

Burton Park, May 21, 1803.

THREE bushels of potatoes were weighed separately, each bushel weighing sixty pounds before they were put into six digesters. The potatoes from the two first digesters, taken out of the oven when baked and weighed together, were fifty-five pounds; and those from the second two, were fifty-four pounds; and those from the third two, were fifty-four pounds. The carpenter measured the wood with with which they were baked, and he tells me a well stacked cord of good fuel-wood will bake ninety sets; or ninety times six digesters, each containing half a bushel of potatoes, at the rate of wood it took to bake the above six, which was the second set baked that day.

A cast iron plate 5 feet long by 2 feet 10 inches, instead of 3 feet 10 inches by 2 feet 10 inches, which mine is, will hold eight digesters, and by adding a small fire thus 

on each side the great fire place, will, in my opinion, accelerate the baking from fifteen to twenty minutes in every set, as well as save some fuel. When mine wants to be reset, I mean to follow the above plan, whether for six or eight digesters.

W. PIERREPONT.

Baking Potatoes for Cattle.

My Lord,

Burton Park, June 23, 1803.

I hereby request both the Board of Agriculture, and your Lordship, will be pleased to accept my best acknowledgment of the due sense I feel for the honour conferred upon me by the Board, and by your Lordship, for having communicated to me the same in your letter of the 10th inst. and which I received on the 18th. Whatever information I have acquired on the subject in question, is fully at the Board's command; and my gratification will be in proportion to the benefit the method may be of to the country at large. The cord, or as it is as often called, the stack of wood, mentioned in the experiment made for the Earl of Egremont on the 21st ult. is 24 feet long, 3 feet wide (that is, the wood is first cut into 3 feet lengths), and 1 foot 10 inches high; and is sold for twelve shillings on the spot in this neighbourhood. Each of the six digesters holds six gallons wine measure, but in potatoe measure each will only hold half a bushel; so that one sack, or three bushels, are baked at a time with one part out of ninety of the above cord, or stack of wood. I have never had occasion for more than six bakings in a day; which six bakings, that is, six sacks, or eighteen bushels, at sixty pounds the bushel, were done within 12 hours, the wood being in a dry state. I believe that eight digesters, with the heat properly spread, would be done in somewhat less time, allowing for that of filling and emptying the two additional ones; and this should be sufficient satisfaction for any person wishing to use the method on a larger scheme. The man and his boy had twelve shillings per week for getting from the heap, washing and baking the potatoes; cleaving the wood for ditto, and feeding stock. The following account is copied from bills that I have by me; from which, and from what I shall say, the Board, and other persons will be able to make a very near calculation of the expence of the apparatus for the different places the method may be tried in, according as the articles necessary may vary in price, and according to the quantity of potatoes, which may be wanted to be baked.

	cwt. qrs. lbs.	£ s. d.
6 Six gallon wine measure digesters, at 18*s.* a piece		5 8 0
A cast iron plate 3 feet 10 inches by 2 feet 10 inches,	2 1 19	2 16 0
Two strong cast bearing bars - - -	0 1 25	0 10 0
An extra double door and frame mounted with two doors at top and two at bottom, with cranks to open together, and corkings - - - -	0 3 24	4 14 6
		13 8 6

The last mentioned article is not necessary, only for the greater economy of fuel. The other bars, the register, and the old iron for three sides of an eighteen inch square, with projections at the four corners to tie it in the brick work forming the mouth of the oven, I had by me: the door to which is wood faced with tin; but I am not satisfied with that, because it is so apt to burn. I could wish the door to be something similar to that of the mouth of the fire-place, which would be so much more convenient for confining the heat in the oven, and keeping out the external air, both when the digesters are taken out and filling, and when closed up at night. Perhaps an orifice just above the mouth of the oven, or in the door, with a moveable valve fixed to it, would prove useful, that the steam, which issues from those of the digesters about ten or fifteen minutes before the potatoes are done, and which steam smells like roasted ones, may escape by it, instead of by the mouth of the oven. The above steam is attended by a hissing noise, and kind of boiling commotion in the digesters, which the person attending them will very plainly hear on opening the door a little, and when he perceives that noise, &c. to intermit, the digesters must be taken out, or the potatoes will burn at the bottom, and that in proportion to the heat under them. A very little observation will soon make any person acquainted with the proper time of their being done. About the sixth part of an inch below the upper surface of the cast iron plate at the mouth of the oven, is a piece of sheet iron, two feet long by seven wide, to rest the digesters on, in moving them to and from the oven, that the door may be the closer at the bottom. I have been thus minute (perhaps tediously so) on my oven, that any person willing to try this method may profit, in forming his ideas on the subject, without being at the pains, &c. that I was, by the result of the many and various experiments I have made. Let the person keep in mind, 1st, that the digesters must not be in contact with the fire; 2d, that the said digesters, or other vessels, even placed on

cast iron must have legs, so that the bottoms of them do not touch the cast iron; 3d, that the vessels used must have lids steam tight, and valves similar to those of the digesters; but it is not by slow simmering that this process is performed the best. The quicker the potatoes are done in reason the better; and 4th, that the external air is to be excluded from them. With observing these four circumstances every person may exercise his own judgment, indulge his own fancy and information, relative to the management of fuel, and erecting his oven, whether it be for fewer or more digesters, according to the quantity he may wish to bake. My opinion is, that two ovens of six or eight digesters each would answer the best purpose where a great quantity of food is wanted, particularly where coals are used, or the wood is ready cut; for then the same person could attend both, and one would be baking whilst he was drawing the other. Perhaps two ovens erected together with a single brick laid flat to divide them, and the fires at the end, so that each flue would go the whole length of the plate, mounting at the other end, and so over the top; and the two doors of them at the two fronts would answer very well in point of economy.

I have the honour to be, my Lord,

your Lordship's very obedient humble servant,

WM. PIERREPONT.

Board of Agriculture.

No. XI.

On the Analysis of Soils, as connected with their Improvement. *By* Humphry Davy, *Esq. F. R. S.*

I. *Utility of Investigations relating to the Analysis of Soils.*

THE methods of improving lands are immediately connected with the knowledge of the chemical nature of soils, and experiments on their composition appear capable of many useful applications.

The importance of this subject has been already felt by some very able cultivators of science; many useful facts and observations with regard to it have been furnished by Mr. Young; it has been examined by Lord Dundonald, in his treatise on the connexion of Chemistry with Agriculture, and by Mr. Kirwan in his excellent essay on Manures; but the enquiry is still far from being exhausted, and new methods of elucidating it are almost continually offered, in consequence of the rapid progress of chemical discovery.

In the following pages I shall have the honour of laying before the Board, an account of those methods of analysing soils which appear most precise and simple, and most likely to be useful to the practical farmer; they are founded partly upon the labours of the gentlemen, whose names have been just mentioned, and partly upon some later improvements.

II. *Of the Substances found in Soils.*

The substances which are found in soils, are certain mixtures or combinations of some of the primitive earths, animal and vegetable matter in a decomposing state, certain saline compounds, and the oxide of iron. These bodies always retain water, and exist in very different proportions in different lands; and the end of analytical experiments is the detection of their quantities and mode of union.

The *earths* found in common soils are principally *silex*, or the earth of flints, alumine, or the pure matter of clay, lime, or calcareous earth, and magnesia.

Silex, or the earth of flints, when perfectly pure, appears in the form of a white powder, which is incombustible, infusible, insoluble in water, and not acted upon by common acids; it is the substance which constitutes the principal part of rock chrystal; it composes a considerable part of hard gravelly soils, of hard sandy soils, and of hard stoney lands.

Alumine, or pure clay, in its perfect state is white like silex; it adheres strongly to the tongue, is incombustible, insoluble in water, but soluble in acids, and in fixed alkaline menstrua. It abounds most in clayey soils and clayey loams; but even in the smallest particles of these soils it is usually united to silex and oxide of iron.

Lime is the substance well known in its pure state under the name of quicklime. It always exists in soils in combination, and that principally with fixed air or carbonic acid, when it is called carbonate of lime; a substance which in the most compact form constitutes marble, and in its looser form chalk. Lime, when combined with sulphuric acid (oil of vitriol), produces sulphate of lime (gypsum), and with phosphoric acid, phosphate of lime. The carbonate of lime, mixed with other substances, composes chalky soils and marles, and it is found in soft sandy soils.

Magnesia, when pure, appears as white, and in a lighter powder, than any of the other earths; it is soluble in acid, but not in alkaline menstrua; it is rarely found in soils; when it does exist, it is either in combination with carbonic acid, or with silex and alumine.

Animal decomposing matter exists in very different states, according as the substances from which it is produced are different; it contains much carbonaceous substance; and may be principally resolved by heat into this substance, volatile alkali, inflammable aeriform products, and carbonic acid; it is principally found in lands that have been lately manured.

Vegetable decomposing matter is likewise very various in kind, it contains usually more carbonaceous substance than animal matter, and differs from it in the results of its decomposition principally in not producing volatile alkali; it forms a great proportion of all peats; it abounds in rich mould, and is found in larger or smaller quantities in all lands.

The *saline compounds* found in soils are very few, and in quantities so small, that they are rarely to be discovered. They are principally muriate of soda (common salt), sulphate of magnesia (Epsom salt), and muriate and sulphate of potash, nitrate of lime, and the mild alkalies.

The *oxide of iron* is the same with the rust produced by exposing iron to the air and water; it is found in all soils, but is most abundant in yellow and red clays, and in yellow and red siliceous sands.

A more minute account of these different substances would be incompatible with the object of this paper. A full description of their properties and agencies may be found in the elementary books on chemistry, and particularly in the System of Chemistry by Dr. Thomson (2d Ed.); and in Henry's Epitome of Chemistry.

III. *Instruments required for the Analysis of Soils.*

The really important instruments required for the analysis of soils are few, and but little expensive. They are a balance capable of containing a quarter of a pound of common soil, and capable of turning, when loaded with a grain; a series of weights from a quarter of a pound Troy to a grain; a wire sieve, sufficiently coarse to admit a pepper corn through its apertures; an Argand lamp and stand; some glass bottles; Hessian crucibles; porcelain, or queen's ware evaporating basons; a Wedgewood pestle and mortar; some filters made of half a sheet of blotting paper, folded so as to contain a pint of liquid, and greased at the edges; a bone knife, and an apparatus for collecting and measuring aeriform fluids.

The chemical substances or reagents required for separating the constituent parts of the soil, are muriatic acid (spirit of salt), sulphuric acid, pure volatile alkali dissolved in water, solution of prussiate of potash, soap lye, solution of carbonate of ammoniac, of muriate of ammonia, solution of neutral carbonate of potash, and nitrate of ammoniac. An account of the nature of these bodies, and their effects, may be found in the chemical works already noticed; and the reagents are sold, together with the instruments mentioned above, by Mr. Knight, Foster Lane, Cheapside, arranged in an appropriate chest.

IV. *Mode of collecting Soils for Analysis.*

In cases when the general nature of the soil of a field is to be ascertained, specimens of it should be taken from different places, two or three inches below the surface, and examined as to the similarity of their properties. It sometimes happens, that upon plains the whole of the upper stratum of the land is of the same kind, and in this case, one analysis will be sufficient; but in vallies, and near the

beds of rivers, there are very great differences, and it now and then occurs that one part of a field is calcareous, and another part siliceous; and in this case, and in analogous cases, the portions different from each other should be separately submitted to experiment.

Soils when collected, if they cannot be immediately examined, should be preserved in phials quite filled with them, and closed with ground glass stoppers.

The quantity of soil most convenient for a perfect analysis, is from two to four hundred grains. It should be collected in dry weather, and exposed to the atmosphere till it becomes dry to the touch.

The specific gravity of a soil, or the relation of its weight to that of water, may be ascertained by introducing into a phial, which will contain a known quantity of water, equal volumes of water and of soil, and this may be easily done by pouring in water till it is half full, and then adding the soil till the fluid rises to the mouth; the difference between the weight of the soil and that of the water, will give the result. Thus if the bottle contains four hundred grains of water, and gains two hundred grains when half filled with water and half with soil, the specific gravity of the soil will be 2, that is, it will be twice as heavy as water, and if it gained one hundred and sixty-five grains, its specific gravity would be 1825, water being 1000.

It is of importance, that the specific gravity of a soil should be known, as it affords an indication of the quantity of animal and vegetable matter it contains; these substances being always most abundant in the lighter soils.

The other physical properties of soils should likewise be examined before the analysis is made, as they denote, to a certain extent, their composition, and serve as guides in directing the experiments. Thus siliceous soils are generally rough to the touch, and scratch glass when rubbed upon it; aluminous soils adhere strongly to the tongue, and emit a strong earthy smell when breathed on; and calcareous soils are soft, and much less adhesive than aluminous soils.

V. *Mode of ascertaining the Quantity of Water of Absorption in Soils.*

Soils, though as dry as they can be made by continued exposure to air, in all cases still contain a considerable quantity of water, which adheres with great obstinacy to the earths and animal and vegetable matter, and can only be driven off from them by a considerable degree of heat. The first process of analysis is, to free

the given weight of soil from as much of this water as possible, without in other respects, affecting its composition; and this may be done by heating it for ten or twelve minutes over an Argand's lamp, in a bason of porcelain, to a temperature equal to 300 * Fahrenheit; and in case a thermometer is not used, the proper degree may be easily ascertained, by keeping a piece of wood in contact with the bottom of the dish; as long as the colour of the wood remains unaltered, the heat is not too high; but when the wood begins to be charred, the process must be stopped. A small quantity of water will perhaps remain in the soil even after this operation, but it always affords useful comparative results; and if a higher temperature were employed, the vegetable or animal matter would undergo decomposition, and in consequence the experiment be wholly unsatisfactory.

The loss of weight in the process should be carefully noted, and when in four hundred grains of soil it reaches as high as 50, the soil may be considered as in the greatest degree absorbent, and retentive of water, and will generally be found to contain a large proportion of aluminous earth. When the loss is only from 20 to 10, the land may be considered as only slightly absorbent and retentive, and the silicious earth as most abundant.

VI. *Of the Separation of Stones, Gravel, and vegetable Fibres from Soils.*

None of the loose stones, gravel, or large vegetable fibres should be divided from the pure soil till after the water is drawn off; for these bodies are themselves often highly absorbent and retentive, and in consequence influence the fertility of the land. The next process, however, after that of heating, should be their separation, which may be easily accomplished by the sieve, after the soil has been gently bruised in a mortar. The weights of the vegetable fibres or wood, and of the gravel and stones should be separately noted down, and the nature of the last ascertained; if calcareous, they will effervesce with acids; if siliceous, they will be sufficiently hard to scratch glass; and if of the common aluminous class of stones, they will be soft, easily scratched with a knife, and incapable of effervescing with acids.

* In several experiments, in which this process has been carried on by distillation, I have found the water that came over pure, and no sensible quantity of other volatile matter was produced.

VII. *Separation of the Sand and Clay, or Loam, from each other.*

The greater number of soils, besides gravel and stones, contain larger or smaller proportions of sand of different degrees of fineness; and it is a necessary operation, the next in the process of analysis, to detach them from the parts in a state of more minute division, such as clay, loam, marle, and vegetable and animal matter. This may be effected in a way sufficiently accurate, by agitation of the soil in water. In this case, the coarse sand will generally separate in a minute, and the finer in two or three minutes, whilst the minutely divided earthy, animal, or vegetable matter will remain in a state of mechanical suspension for a much longer time; so that by pouring the water from the bottom of the vessel, after one, two, or three minutes, the sand will be principally separated from the other substances, which, with the water containing them, must be poured into a filter, and after the water has passed through, collected, dried, and weighed. The sand must likewise be weighed, and their respective quantities noted down. The water of lixiviation must be preserved, as it will be found to contain the saline matter, and the soluble animal or vegetable matters, if any exist in the soil.

VIII. *Examination of the Sand.*

By the process of washing and filtration, the soil is separated into two portions, the most important of which is generally the finely divided matter. A minute analysis of the sand is seldom or never necessary, and its nature may be detected in the same manner as that of the stones or gravel. It is always either silicious sand, or calcareous sand, or a mixture of both. If it consist wholly of carbonate of lime, it will be rapidly soluble in muriatic acid, with effervescence; but if it consist partly of this substance, and partly of silicious matter, the respective quantities may be ascertained by weighing the residuum after the action of the acid, which must be applied till the mixture has acquired a sour taste, and has ceased to effervesce. This residuum is the silicious part: it must be washed, dried, and heated strongly in a crucible; the difference between the weight of it and the weight of the whole, indicates the proportion of calcareous sand.

IX. *Examination of the finely divided Matter of Soils, and Mode of detecting mild Lime and Magnesia.*

The finely divided matter of the soil is usually very compound in its nature; it sometimes contains all the four primitive earths of soils, as well as animal and vegetable matter; and to ascertain the proportions of these with tolerable accuracy, is the most difficult part of the subject.

The first process to be performed, in this part of the analysis, is the exposure of the fine matter of the soil to the action of the muriatic acid. This substance should be poured upon the earthy matter in an evaporating bason, in a quantity equal to twice the weight of the earthy matter; but diluted with double its volume of water. The mixture should be often stirred, and suffered to remain for an hour or an hour and a half before it is examined.

If any carbonate of lime or of magnesia exist in the soil, they will have been dissolved in this time by the acid, which sometimes takes up likewise a little oxide of iron; but very seldom any alumine.

The fluid should be passed through a filter; the solid matter collected, washed with rain water, dried at a moderate heat, and weighed. Its loss will denote the quantity of solid matter taken up. The washings must be added to the solution, which if not sour to the taste, must be made so by the addition of fresh acid, when a little solution of common prussiate of potash must be mixed with the whole. If a blue precipitate occurs, it denotes the presence of oxide of iron, and the solution of the prussiate must be dropped in till no farther effect is produced. To ascertain its quantity, it must be collected in the same manner as other solid precipitates, and heated red; the result is oxide of iron.

Into the fluid freed from oxide of iron, a solution of neutralized carbonate of potash must be poured till all effervescence ceases in it, and till its taste and smell indicate a considerable excess of alkaline salt.

The precipitate that falls down is carbonate of lime; it must be collected on the filter, and dried at a heat below that of redness.

The remaining fluid must be boiled for a quarter of an hour, when the magnesia, if any exist, will be precipitated from it, combined with carbonic acid, and its quantity is to be ascertained in the same manner as that of the carbonate of lime.

If any minute proportion of alumine should, from peculiar circumstances, be dissolved by the acid, it will be found in the precipitate with the carbonate of lime,

and it may be separated from it by boiling for a few minutes with soap lye, sufficient to cover the solid matter. This substance dissolves alumine, without acting upon carbonate of lime.

Should the finely divided soil be sufficiently calcareous to effervesce very strongly with acids, a very simple method may be adopted for ascertaining the quantity of carbonate of lime, and one sufficiently accurate in all common cases.

Carbonate of lime, in all its states, contains a determinate proportion of carbonic acid, *i. e.* about 45 per cent. so that when the quantity of this elastic fluid, given out by any soil during the solution of its calcareous matter in an acid is known, either in weight or measure, the quantity of carbonate of lime may be easily discovered.

When the process by diminution of weight is employed, two parts of the acid and one part of the matter of the soil must be weighed in two separate bottles, and very slowly mixed together till the effervescence ceases; the difference between their weight before and after the experiment, denotes the quantity of carbonic acid lost; for every four grains and a half of which, ten grains of carbonate of lime must be estimated.

The best method of collecting the carbonic acid, so as to discover its volume, is by the pneumatic apparatus, the construction and application of which is described at the end of this paper. The estimation is, for every ounce measure of carbonic acid, two grains of carbonate of lime.

X. *Mode of ascertaining the Quantity of insoluble finely divided animal and vegetable Matter.*

After the fine matter of the soil has been acted upon by muriatic acid, the next process is to ascertain the quantity of finely divided insoluble animal and vegetable matter that it contains.

This may be done with sufficient precision, by heating it to strong ignition in a crucible over a common fire till no blackness remains in the mass. It should be often stirred with a metallic wire, so as to expose new surfaces continually to the air; the loss of weight that it undergoes denotes the quantity of the substance that it contains destructible by fire and air.

It is not possible to ascertain whether this substance is wholly animal or vegetable matter, or a mixture of both. When the smell emitted during the incineration is

similar to that of burnt feathers, it is a certain indication of some animal matter; and a copious blue flame at the time of ignition, almost always denotes a considerable proportion of vegetable matter. In cases when the experiment is needed to be very quickly performed, the destruction of the decomposible substances may be assisted by the agency of nitrate of ammoniac, which at the time of ignition may be thrown gradually upon the heated mass in the quantity of twenty grains for every hundred of residual soil. It affords the principle necessary to the combustion of the animal and vegetable matter, which it causes to be converted into elastic fluids; and it is itself at the same time decomposed and lost.

XI. *Mode of separating aluminous and silicious Matter and Oxide of Iron.*

The substances remaining after the decomposition of the vegetable and animal matter, are generally minute particles of earthy matter, containing usually alumine and silex with combined oxide of iron.

To separate these from each other, the solid matter should be boiled for two or three hours with sulphuric acid, diluted with four times its weight of water; the quantity of the acid should be regulated by the quantity of solid residuum to be acted on, allowing for every hundred grains two drachms or one hundred and twenty grains of acid.

The substance remaining after the action of the acid, may be considered as silicious; and it must be separated and its weight ascertained, after washing and drying in the usual manner.

The alumine and the oxide of iron, if any exist, are both dissolved by the sulphuric acid; they may be separated by carbonate of ammoniac, added to excess; it throws down the alumine, and leaves the oxide of iron in solution, and this substance may be separated from the liquid by boiling.

Should any magnesia and lime have escaped solution in the muriatic acid, they will be found in the sulphuric acid; this, however, is scarcely ever the case; but the process for detecting them and ascertaining their quantities, is the same in both instances.

The method of analysis by sulphuric acid, is sufficiently precise for all usual experiments; but if very great accuracy be an object, dry carbonate of potash must be employed as the agent, and the residuum of the incineration must be heated red

for a half hour, with four times its weight of this substance, in a crucible of silver, or of well baked porcelain. The mass obtained must be dissolved in muriatic acid, and the solution evaporated till it is nearly solid; distilled water must then be added, by which the oxide of iron and all the earths, except silex, will be dissolved in combination as muriates. The silex, after the usual process of lixiviation, must be heated red; the other substances may be separated in the same manner as from the muriatic and sulphuric solutions.

This process is the one usually employed by chemical philosophers for the analysis of stones.

XII. *Mode of discovering soluble animal and vegetable Matter, and saline Matter.*

If any saline matter, or soluble vegetable or animal matter, is suspected in the soil, it will be found in the water of lixiviation used for separating the sand.

This water must be evaporated to dryness in an appropriate dish, at a heat below its boiling point.

If the solid matter obtained is of a brown colour and inflammable, it may be considered as partly vegetable extract. If its smell, when exposed to heat, be strong and fetid, it contains animal mucilaginous or gelatinous substance; if it be white and transparent, it may be considered as principally saline matter. Nitrate of potash (nitre) or nitrate of lime, is indicated in this saline matter, by its scintillating with a burning coal. Sulphate of magnesia may be detected by its bitter taste; and sulphate of potash produces no alteration in solution of carbonate of ammoniac, but precipitates solution of muriate of barytes.

XIII. *Mode of detecting Sulphate of Lime (Gypsum) and Phosphate of Lime in Soils.*

Should sulphate or phosphate of lime be suspected in the entire soil, the detection of them requires a particular process upon it. A given weight of it, for instance four hundred grains, must be heated red for half an hour in a crucible, mixed with one-third of powdered charcoal. The mixture must be boiled for a quarter of an hour, in a half pint of water, and the fluid collected through the filter, and exposed for some days to the atmosphere in an open vessel. If any soluble quantity of sulphate of lime (gypsum) existed in the soil, a white precipitate will gradually form in the fluid, and the weight of it will indicate the proportion.

Phosphate of lime, if any exist, may be separated from the soil after the process for gypsum. Muriatic acid must be digested upon the soil, in quantity more than sufficient to saturate the soluble earths; the solution must be evaporated, and water poured upon the solid matter. This fluid will dissolve the compounds of earths with the muriatic acid, and leave the phosphate of lime untouched.

It would not fall within the limits assigned to this paper, to detail any processes for the detection of substances which may be accidentally mixed with the matters of soils. Manganese is now and then found in them, and compounds of the barytic earth; but these bodies appear to bear little relation to fertility or barrenness, and the search for them would make the analysis much more complicated without rendering it more useful.

XIV. *Statement of Results and Products.*

When the examination of a soil is completed, the products should be classed, and their quantities added together, and if they nearly equal the original quantity of soil, the analysis may be considered as accurate. It must, however, be noticed, that when phosphate or sulphate of lime are discovered by the independent process XIII. a correction must be made for the general process, by subtracting a sum equal to their weight from the quantity of carbonate of lime, obtained by precipitation from the muriatic acid.

In arranging the products, the form should be in the order of the experiments by which they were obtained.

Thus 400 grains of a good silicious sandy soil may be supposed to contain

		Grains.
Of water of absorption		18
Of loose stones and gravel principally silicious		42
Of undecompounded vegetable fibres		10
Of fine silicious sand		200
Of minutely divided matter separated by filtration and consisting of		
Carbonate of lime		25
Carbonate of magnesia		4
Matter destructible by heat, principally vegetable		10
Carried forward	39	270

		Grains.
Brought forward	39	270
Silex - - - - -	40	
Alumine - - - - -	32	
Oxide of iron - - - - -	4	
Soluble matter, principally sulphate of potash and vegetable extract - - - - -	5	
Gypsum - - - - - -	3	
Phosphate of lime - - - -	2	
		125
Amount of all the products		395
Loss - - -		5

In this instance the loss is supposed small; but in general, in actual experiments, it will be found much greater, in consequence of the difficulty of collecting the whole quantities of the different precipitates; and when it is within thirty for four hundred grains, there is no reason to suspect any want of due precision in the processes.

XV. *This general Method of Analysis may in many Cases be much simplified.*

When the experimenter is become acquainted with the use of the different instruments, the properties of the reagents, and the relations between the external and chemical qualities of soils, he will seldom find it necessary to perform, in any one case, all the processes that have been described. When his soil, for instance, contains no notable proportion of calcareous matter, the action of the muriatic acid IX. may be omitted. In examining peat soils, he will principally have to attend to the operation by fire and air X.; and in the analysis of chalks and loams, he will often be able to omit the experiment by sulphuric acid XI.

In the first trials that are made by persons unacquainted with chemistry, they must not expect much precision of result. Many difficulties will be met with; but in overcoming them, the most useful kind of practical knowledge will be obtained; and nothing is so instructive in experimental science, as the detection of mistakes. The correct analyst ought to be well grounded in general chemical information; but perhaps there is no better mode of gaining it, than that of attempting original

investigations. In pursuing his experiments, he will be continually obliged to learn from books, the history of the substances he is employing or acting upon; and his theoretical ideas will be more valuable in being connected with practical operation, and acquired for the purpose of discovery.

XVI. *On the Improvement of Soils, as connected with the Principle of their Composition.*

In cases when a barren soil is examined with a view to its improvement, it ought in all cases, if possible, to be compared with an extremely fertile soil in the same neighbourhood, and in a similar situation: the difference given by their analyses would indicate the methods of cultivation; and thus the plan of improvement would be founded upon accurate scientific principles.

If the fertile soil contained a large quantity of sand, in proportion to the barren soil, the process of amelioration would depend simply upon a supply of this substance; and the method would be equally simple with regard to soils deficient in clay or calcareous matter.

In the application of clay, sand, loam, marle, or chalk to lands, there are no particular chemical principles to be observed; but when quick lime is used, great care must be taken that it is not obtained from the magnesian limestone; for in this case, as has been shewn by Mr. Tennant, it is exceedingly injurious to land.* The magnesian limestone may be distinguished from the common limestone by its greater hardness, and by the length of time that it requires for its solution in acids, and it may be analysed by the process for carbonate of lime and magnesia IX.

When the analytical comparison indicates an excess of vegetable matter, as the cause of sterility, it may be destroyed by much pulverization and exposure to air, by paring and burning, or the agency of lately made quicklime. And the defect of animal and vegetable matter must be supplied by animal or vegetable manure.

* Phil. Transactions for 1799, p. 305. This limestone is found abundantly in Yorkshire, Derbyshire, and Somersetshire.

XVII. *Sterile Soils in different Climates and Situations must differ in Composition.*

The general indications of fertility and barrenness, as found by chemical experiments, must necessarily differ in different climates, and under different circumstances. The power of soils to absorb moisture, a principal essential to their productiveness, ought to be much greater in warm and dry countries, than in cold and moist ones; and the quantity of fine aluminous earth they contain larger. Soils likewise that are situated on declivities, ought to be more absorbent than those in the same climate on plains or in vallies.* The productiveness of soils must likewise be influenced by the nature of the subsoil, or the earthy or stony strata on which they rest; and this circumstance ought to be particularly attended to, in considering their chemical nature, and the system of improvement. Thus a sandy soil may sometimes owe its fertility to the power of the subsoil to retain water; and an absorbent clayey soil may occasionally be prevented from being barren, in a moist climate, by the influence of a substratum of sand or gravel.

XVIII. *Of the chemical Composition of fertile Corn Soils in this Climate.*

Those soils that are most productive of corn, contain always certain proportions of aluminous and calcareous earth in a finely divided state, and a certain quantity of vegetable or animal matter.

The quantity of calcareous earth is however very various, and in some cases exceedingly small. A very fertile corn soil from Ormiston in East Lothian afforded me in an hundred parts, only eleven parts of mild calcareous earth; it contained twenty-five parts of silicious sand; the finely divided clay amounted to forty-five parts. It lost nine in decomposed animal and vegetable matter, and four in water, and afforded indications of a small quantity of phosphate of lime.

This soil was of a very fine texture, and contained very few stones or vegetable fibres. It is not unlikely that its fertility was in some measure connected with the phosphate; for this substance is found in wheat, oats, and barley, and may be a part of their food.

A soil from the low lands of Somersetshire, celebrated for producing excellent crops of wheat and beans without manure, I found to consist of one-ninth of sand,

* Kirwan. Trans. Irish Academy, Vol. V. p. 175.

chiefly silicious, and eight-ninths of calcareous marle tinged with iron, and containing about five parts in the hundred of vegetable matter. I could not detect in it any phosphate or sulphate of lime, so that its fertility must have depended principally upon its power of attracting principles of vegetable nourishment from water and the atmosphere.*

Mr. Tillet, in some experiments made on the composition of soils at Paris, found that a soil composed of three-eighths of clay, two-eighths of river sand, and three-eighths of the parings of limestone, was very proper for wheat.

XIX. *Of the Composition of Soils proper for bulbous Roots and for Trees.*

In general, bulbous roots require a soil much more sandy, and less absorbent than the grasses. A very good potatoe soil, from Varfel in Cornwall, afforded me seven-eighths of silicious sand; and its absorbent power was so small, that one hundred parts lost only two by drying at 400 Fahrenheit.

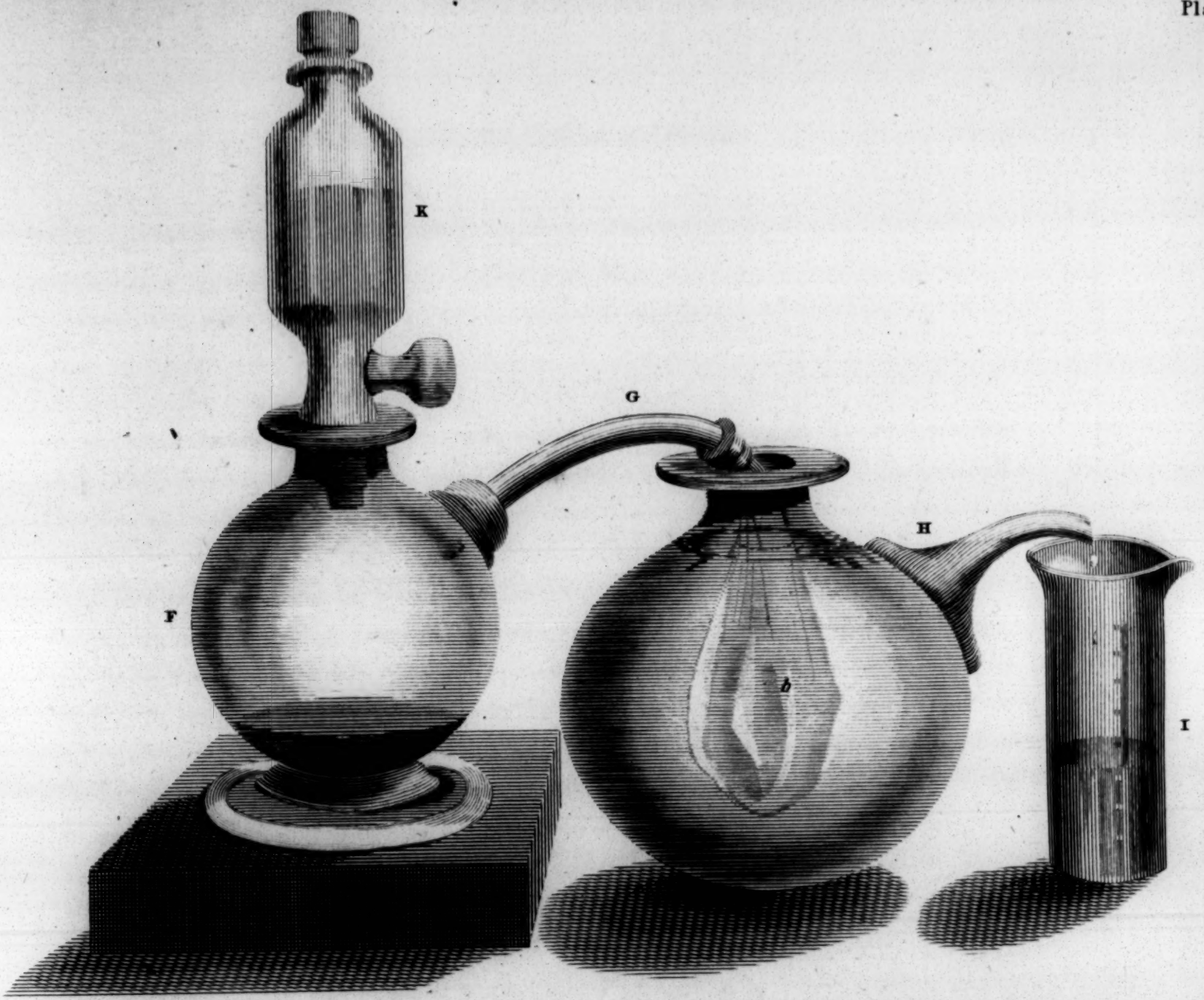
Plants and trees, the roots of which are fibrous and hard, and capable of penetrating deep into the earth, will vegetate to advantage in almost all common soils which are moderately dry, and which do not contain a very great excess of vegetable matter.

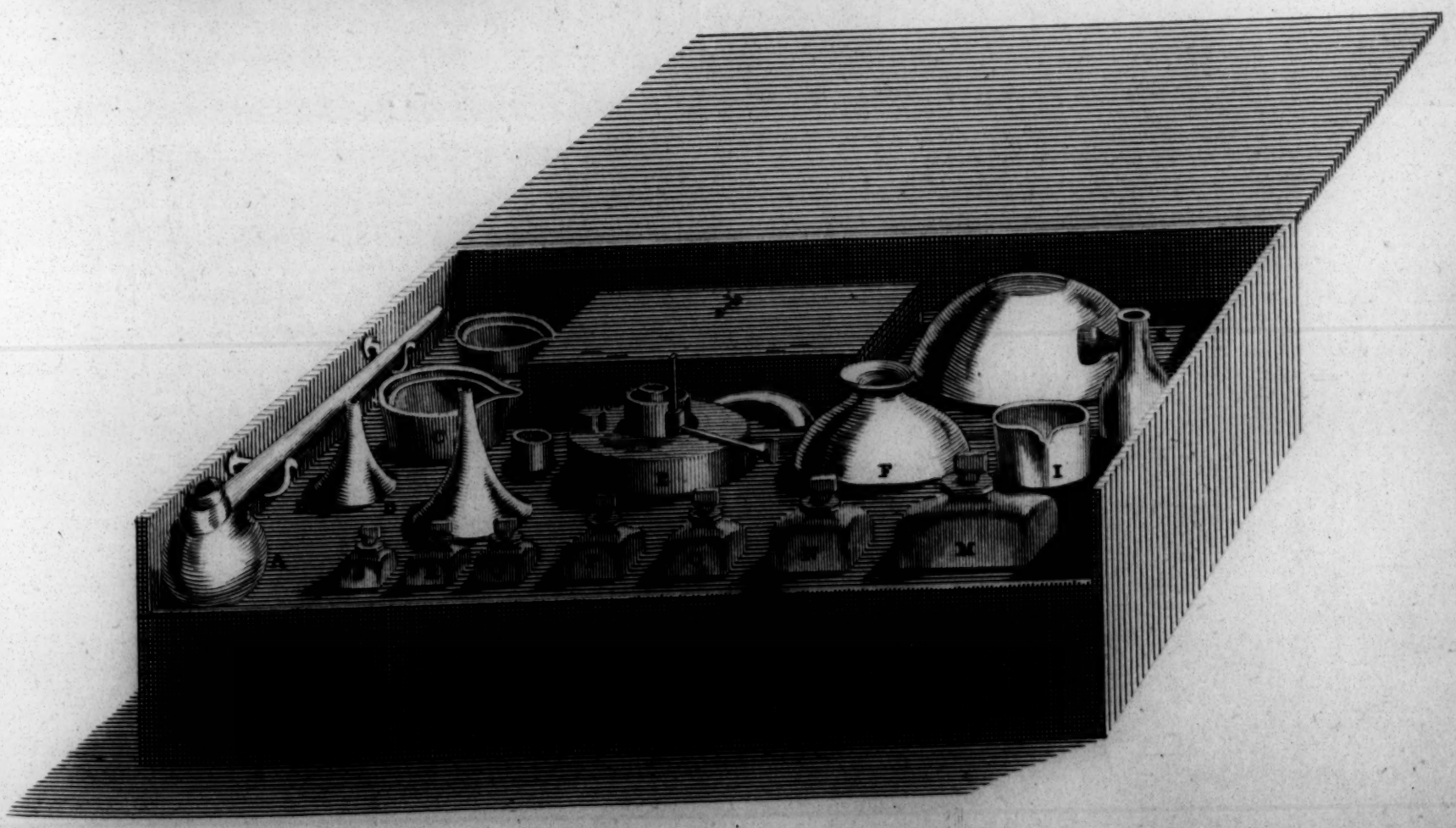
I found the soil taken from a field at Sheffield-place in Sussex, remarkable for producing flourishing oaks, to consist of six parts of sand, and one part of clay and finely divided matter. And one hundred parts of the entire soil submitted to analysis, produced

	Parts.
Water - - -	3
Silex - - - - -	54
Alumine - - - -	28
Carbonate of lime - - -	3
Oxide of iron - - - -	5
Decomposing vegetable matter - -	4
Loss - - - -	3

* This soil was sent to me by T. Poole, Esq. of Nether Stowey. It is near the opening of the river Parret into the British Channel; but, I am told, is never overflowed.

Plate IX.





Neale sculp Strand.

G.R. III.
BRITISH MUSEUM

XX. *Advantages of Improvements made by changing the Composition of the earthy Parts of Soils.*

From the great difference of the causes that influence the productiveness of lands, it is obvious that in the present state of science, no certain system can be devised for their improvement, independent of experiment; but there are few cases in which the labour of analytical trials will not be amply repaid by the certainty with which they denote the best methods of amelioration; and this will particularly happen, when the defect of composition is found in the proportions of the primitive earths.

In supplying animal or vegetable manure, a temporary food only is provided for plants, which is in all cases exhausted by means of a certain number of crops; but when a soil is rendered of the best possible constitution and texture, with regard to its earthy parts, its fertility may be considered as permanently established. It becomes capable of attracting a very large portion of vegetable nourishment from the atmosphere, and of producing its crops with comparatively little labour and expence.

Description of the Apparatus for the Analysis of Soils.

A. Retort.

B B. Funnels for the purpose of filtrating.

D. Balance.

E. Argand's lamp.

F, G, H, K. The different parts of the apparatus required for measuring the quantity of elastic fluid given out during the action of an acid on calcareous soils. F. Represents the bottle for containg the soil. K. The bottle containing the acid furnished with a stopcock. G. The tube connected with a flaccid bladder. I. The graduated measure. H. The bottle for containing the bladder. When this instrument is used, a given quantity of soil is introduced into F; K is filled with muriatic acid diluted with an equal quantity of water; and the stop-cock being closed is connected with the upper orifice of F, which is ground to receive it. The tube G is introduced into the lower orifice of F, and the bladder connected with it placed in its flaccid state into H, which is filled with water. The graduated measure is placed under the tube of H. When the stop-cock of K is turned, the acid flows into F, and acts upon the soil; the elastic fluid generated passes through G into the bladder, and displaces a quantity of water in H equal to it in bulk, and this water flows through the tube into the graduated measure: the water in which gives by its volume the indication of the proportion of carbonic acid disengaged from the soil; for every ounce measure of which two grains of carbonate of lime may be estimated.

L. Represents the stand for the lamp.

M, N, O, P, Q, R, S. Represent the bottles containing the different reagents.

No. XI.

A Communication on the Use of Green Vitriol, or Sulphate of Iron, as a Manure; and on the Efficacy of Paring and Burning depending, partly, on Oxide of Iron. *By* George Pearson, *M. D. Honorary Member of the Board of Agriculture, F. R. S. &c. &c.—Read November,* 1801.

I TAKE leave to lay before this Honourable Board, an account of a substance as a manure, which I find, on examination, is one of the things, hitherto universally believed to be a poison to vegetables. Having ascertained that this substance is what is commonly known by the name of vitriol of iron (the sulphate of iron of the chemists), inveterate opinion prevented me for some time from accepting the testimony of it as a manure; but feeling the weight of the respectable evidence by whom it was attested, after consideration I perceived that the fact in question was not at variance with established principles of vegetable philosophy, as I shall, I think, make appear in this Communication.

My friend John Williams Willaume, Esq. of Tingrith in Bedfordshire, having desired his brother, Charles Dymoke Willaume, Esq. to ask my opinion of a saline substance collected from peat, which has been used with profitable consequences as a manure in his neighbourhood; I proposed a set of queries to Mr. John W. Willaume, the answers to which, in the two following copied letters, comprehend the evidence I have to offer.

LETTER No. I.—*To Dr. Pearson, from C. D. Willaume, Esq.*

My dear Sir,

I RECEIVED the inclosed last Saturday, and hope the answers to your queries will be satisfactory, and tend to elucidate this curious subject. Though the answers under the article *dust* only relate to your queries, yet my brother has thought proper to advert to the *ashes*, which you conceive to be a *caput mortuum*; but which have been used as, and have been supposed to be, a beneficial manure from

time immemorial. I have reserved a piece of the peat from which the ashes are produced, and if you would wish to analyse it, I will send it you. Favour me with the result of your future inquiries on this subject, and I am,

My dear Sir, yours very sincerely,

Walham Green,
Aug. 24, 1801.

C. D. WILLAUME.

LETTER No. II.—*From John W. Willaume, Esq. to C. D. Willaume, Esq.*

Queries proposed by Dr. Pearson.

1. How long has the salt of peat been used?
2. How much per acre is laid on?
3. On what kind of lands?
4. The effects of it on vegetation?
5. Whether it is mixed with dung manure, or lime?
6. In what parts of the country has it been employed?
7. Any other facts which can be collected relative to the use of this substance?

In answering the above queries, I shall divide the subject into three articles, 1st, the *peat* considered as an object of fuel; 2d, the *ashes*; 3d, the *salt of peat, or dust*; the two last as objects of manure.

1. *Peat.*

The peat, which is found after the removal of the turf or exterior surface, to about a spade's depth, has long been known as an article of fuel. It is, however, used only by cottagers, who burn it on a brick hearth; it has been rejected from the parlour, the kitchen, the brewhouse, &c. as being injurious to grates, and to all sorts of vessels put on it; it cannot be employed in the roasting of meat, as it will impart a disagreeable taste, and it is destructive of all sorts of furniture by the effluvia which it emits, or by the dust or ashes which may chance to be blown from it. If these disagreeable consequences could be obviated, it might be made an article of general consumption as a substitute for coal, much to the advantage of the seller and consumer; it is dug out in the form of a brick to a certain depth, well known to the common labourer. This depth must be carefully attended to,

lest you should cut out the staple, in which case it would never be retrieved; but, this circumstance attended to, it will grow again to its former state in the space of fifteen years. Thus the whole moor is divided into proper portions, and periodically cut once in fifteen years.

2. *Ashes.*

The turf or surface, and such parts of the peat as do not appear to be of the best quality, are laid up in considerable heaps, and reduced to ashes by the action of fire. *The ashes are red.*

Answer to Queries.

1. The ashes have been long known as a manure, and the demand is on the increase.

2. The quantity usually laid on an acre, by spreading or sowing it, is fifty bushels, either on grass or arable land.

3. It is laid on hot land. By hot land, we understand sandy, gravelly, chalky soils of a dry nature, such as are burnt up on the long continuance of hot weather. It is most commonly used for grasses; but is in considerable esteem, as a manure, for oats or barley on land of the nature abovementioned.

4. The vegetable effect is surprising, inasmuch as it will double or treble a crop of any new sown grass, such as trefoil, &c. I have seen the benefits arising from it on old pasture land much overgrown with moss, which it effectually destroys, and produces in its stead white or Dutch clover. You may trace to an inch the cessation and recommencement of this manure. It is observable, that near the fire heaps, as far as the wind can carry the lighter parts of the ashes, the production of clover is sure to be abundant; it is equally favourable to the growth of barley or oats.

5. It is not mixed with lime, or any other manure.

6. These ashes are bought by a set of higlers, who carry them in bags loaded on asses to a considerable distance, where they are known to be in great repute; they must come excessively dear to the consumer by this mode of conveyance. The farmers in the vicinity send for them in waggons, particularly Mr. Brumiger, near Sundon in Bedfordshire, a considerable and intelligent farmer, who increases his consumption every year, both for his grass and arable land.

3. *The Salt of Peat, or Dust.*

Answer to Queries.—1. The dust or gray saline substance is produced by beating the earth containing this salt to a powder; it is found in particular spots, not universally, the earth not being equally impregnated with it in all places; it has not been known as a manure above six years; but on trial greatly increases in reputation and demand.

2. Fifty bushels are the proper quantity per acre. This should not be exceeded, for if it be laid on in too great abundance, it may prove extremely deleterious.

3. It is used for cold lands. By cold lands we understand clayey, or any wet grounds.

4. It will much improve the vegetation of sowed grasses, and old pasture, and is equally favourable to the production of corn; the ground, whether grass or arable, being of a cold nature.

5. It is not mixed with lime, or any other substance.

6. The dust is likewise bought by the higlers, and carried to great distances. The nearer farmers likewise send for the dust in waggons, particularly Mr. Anstie, of Dunstable Houghton, and Mr. Smith, of Sundon, who hold this manure in great esteem.

Yours, &c.

Tingrith, Aug. 19, 1801. J. W. Willaume.

Dr. Pearson's *Experiments, Observations, and Remarks on the Substance called Salt of Peat, or Dust.*

1. It is a blackish gray, coarse, and rather heavy powder. Has no smell; tastes strongly styptic; readily dissolves in the mouth; did not deliquesce on exposure to the air.

2. Dissolves in four times its weight of water of the temperature of sixty degrees of Fahrenheit, and in twice its weight of boiling hot water, giving a pale green coloured solution, with a trifling sediment, which is insoluble in muriatic acid.

3. To the solution (2) I added a little liquid prussiate of vegetable alkali in a perfectly neutral state, which occasioned immediately a most abundant precipitation of prussiate of iron; and this test was added gradually, till no further precipitation took place.

4. Into the decanted and filtrated fluid (3) was poured liquid caustic volatile alkali, but without inducing any change.

5. Into the same fluid (3) was poured liquid carbonate of vegetable alkali, which produced a scarcely perceivable cloudy appearance.

6. Into the solution (3) was dropped the aqueous solution of muriate of baryt, which occasioned immediately a milky appearance.

7. To the solution (3) I added the oxalic acid, and turbidness ensued.

8. A little of the powdery substance, called the salt of peat, with concentrated sulphuric acid, produced no emission of fumes, nor smell.

9. The solution (2) with muriate of baryt, immediately grew thick and white as cream.

10. The solution (2) with carbonate of potash, deposited a very copious greenish sediment; and the same effect ensued with caustic volatile alkali.

11. The solution (2) with oxalic acid, gave instantly a very turbid bluish green precipitation.

The preceding experiments manifested that the *peat salt* consists of *sulphate of iron*, vulgarly called green vitriol of iron, mixed with a very minute proportion of silicious earth, and of lime united either to sulphuric acid, or to carbonic acid. But the presence of the earths magnesia and argill; the uncombined alkalies; the uncombined acids; are by these experiments excluded. In short, the salt of peat is almost pure *sulphate of iron.*

Remarks.

1. The salt of peat is, I apprehend, deposited by evaporations which run over the moors, where it is found; and hence I should expect many of such waters to be strongly impregnated with it, and in many parts the soil to be tinged red and yellow by ochre. Very likely * on inquiry much iron pyrites will be found on, or near the moors.

2. The quantity spread on land is said to be fifty bushels per acre, which I estimate at 2,250 pounds avoirdupoise; this will give near seven ounces and a half per square yard. If a larger quantity be applied, it is observed it will prove extremely deleterious. This is true also of every other manure, such as lime, alkaline

* "This is," says Mr. Willaume, "exactly the fact. This sulphate of iron, the salt of peat, during the heat of the summer is frequently found in a chrystalized state, very white, and crackling under the feet; but is deliquescent in that form, and turns to its former dark colour when the air becomes moist."—*Note by Mr. J. W. Willaume.*

salts, marine salt, nay, of the dung of animals: for if they be used in certain quantities, they *poison* plants, instead of promoting their growth. This is equally true in the animal kingdom; for there is not an article taken as food, or as seasoning, which is not a poison, if taken in certain quantities. A human creature may be poisoned or alimented by beef or pudding, according to the quantity of them taken into the stomach. He may be poisoned, or have digestion greatly assisted by salt, or pepper, according to their quantity. In brief, the vulgar notion of the term *poison* is erroneous: for by it is conceived that substances so called are in their nature positively destructive of life; but the truth is that the most virulent poisons are, in all reason and fact, only deleterious according to the quantity applied. White arsenic swallowed in the quantity of ten grains or less, will destroy life; but in the quantity of one-sixteenth of a grain, it is as harmless as a glass of wine; and further, in that dose is a remedy for inveterate agues.

From these considerations I conclude, that there is no admissible contradictory evidence to the testimonies for the fertilizing effect of sulphate of iron, unless by such contravening evidence the quantity stated to be used exceed fifty bushels per acre; it being an established fact, that in certain proportions this metallic salt is a poison to plants.

This discovery of Mr. Willaume will, I think, give new light, so as to explain fully the *rationale* of the improvement of land by the burnt earth and ashes from paring and burning. It is usual to account for the effects of this process, by referring to supposed alkaline or other salts; but of these there is no evidence, nay, on trial I have not detected them, or at least not in any efficient quantity; but this I know, that such earth and ashes contain *oxide of iron*, and as I suspect of *manganese*; which from the analysis, and the effect of salt of peat, must now be admitted into the class of manures. This very communication of Mr. Willaume, affords evidence of the truth of this conjecture, for the *ashes of the peat which affords the salt* " have been long known as a manure, and the demand is on the increase:" of course, these ashes contain an unusual quantity of oxide of iron. A consequence of this reasoning is, that the burnt earth of soils will, *cæteris paribus*, fertilize in proportion to the oxide of iron it contains. Accordingly the ashes of the peat, says Mr. Willaume, have a surprising effect, they " will double or treble a crop of any new-sown grass, such as trefoil, &c."; they are so beneficial, that in spite of the expence they are carried in bags by higlers to great distances. It would

be extending this paper beyond the proposed limits, to reason at greater length, and to make a further induction of facts: therefore I will close with asserting, that the more I contemplate the facts in Mr. Willaume's letter, the more evidence I perceive for the truth, that metallic salts, and metallic oxides in general, and salts and oxides of iron in particular, are manures, if applied in proper doses.

I do not think it is within the design of this paper to make observations on the answers to the 2d, 3d, 4th, 5th, and 6th queries, except once for all desiring that it may be understood, that I consider the *salt of peat, and the ashes of peat*, as operating in promoting vegetation analogous to seasoning, or condiments, taken with the food of animals; that is, analogous to mustard, cinnamon, ginger, &c. which are not of themselves at all or necessarily nutritious, but contribute to render other things nutritious, by exciting the action of the stomach and other organs of digestion and assimilation. I have no doubt of the truth of the proposition, that no living thing, neither plant nor animal, can grow and live in a state of visible action without constant supplies of *matter which has been alive*; in other words, *living* animals and vegetables can only live on *dead* animals and *dead* vegetables. No plant, nor animal has ever been known by experience, nor in the nature of things does it seem reasonable, that they can be nourished by mere water and pure air, as some persons have asserted.

I shall make a very few remarks on the other *two substances* which are the subject of Mr. Willaume's letter.

2. *The Peat.*

The peat is a dense mass of vegetable matter for a certain depth, partly in a *dead* and partly in a *living* state, with which is mixed more or less earth, and in burning it affords so much empyreumatic oil, as to give a disagreeable taste to roasted provisions; hence, as we are told, it has been rejected from the kitchen. This fuel affords a vast quantity of what the chemists call *lignic acid*; hence it is rejected also from the parlour, as very destructive to the grates. I beg to suggest that this lignic acid might be saved in burning the peat as fuel, and be used for various purposes in manufactures; and the charred peat may be used in place of charcoal of wood. Probably too other useful products will be found, on examining the matters more accurately which are afforded by distillation.

3. *Ashes.*

If the peat were mere vegetable matter, the ashes afforded by it would be as trifling as those of wood; but some parts of the moor contain so much earth and oxide of iron, as to leave behind, on burning, a considerable quantity of incombustible matter; and such kind of peat, we are told, is not used as fuel; but, after burning, the residuary matter is an efficacious manure, much more so than is commonly afforded by paring and burning. The ashes are more red and more fertilizing than ashes of common turf, because they contain more iron.

The spontaneous springing up of white clover, in land manured with these ashes, is similar to the spontaneous growth of this plant on heath land, which has been covered with lime to destroy all its present vegetation; and this fact shews that probably these are seeds buried in the earth for many ages, which yet remain alive, but do not grow until exposed to the stimuli of air, water, calorific, and lifeless animal, or vegetable matter.

APPENDIX.

THE following facts, lately discovered by most respectable chemists, appear to be worth adding to the preceding memoir, as they serve to shew that other salts, besides sulphate of iron and certain earths, may be employed advantageously as manures, although like iron they have been esteemed deleterious to plants.

1. *Ashes of Pit Coal are a good Manure for Grass.*

My much valued friend, the Rev. Wm. Gregor of Grampound, on examination of the ashes of coal from Liverpool, found them to contain both sulphate of magnesia and sulphate of lime, especially the former, salt. I apprehend that these ashes also contain oxide of iron, or perhaps sulphate of iron. These ashes, says Mr. Gregor, "*skeaded*"* over grass apparently produced good effects *notwithstanding the sulphate of magnesia,* which I was well assured they contained. See Nicholson's Journal, Vol. V. p. 225.

* From Σκιδαω.

From this observation of Mr. Gregor, it seems he is aware of the prevailing popular opinion, that sulphate of magnesia is not favourable to vegetation; and to reconcile his fact with the unfriendly nature of magnesia to plants, as discovered by Mr. Tennant, he observes that the effects of sulphate of magnesia may be very different from those of magnesia and carbonate of magnesia. I apprehend it is the magnesia (calcined magnesia) only which this learned chemist found hurtful to vegetables, as the discovery was made on the examination of Nottingly lime, which the farmers near Doncaster employ as a manure, while they reject the lime of their own neighbourhood. In the latter Mr. Tennant met with magnesia, and in the former none. See the account of this important discovery in the Philos. Transactions.

2. *The Earth from Ashes called Cinis, is a durable and efficacious Manure; by Professor* Mitchill, *of New York, one of the Representatives in Congress. Addressed to Dr.* Pearson.

Dr. Mitchill, in a letter addressed to me on *cinis*, or earth found in the ashes of wood, has made some observations relative to the preceding memoir, which seem worthy of notice.

" Ashes of wood contain very commonly sulphate of potash, also phosphoric acid, besides other well known salts; but after these salts are separated by lixiviation, there remains a *peculiar earth*, and a small proportion of iron. This earth differs from lime, baryt, magnesia, strontian, or any other known species of earth. I would call it *cinis*, for plentiful, common, and important as it is, science has not dignified it with a name. To judge of the excellence of this earth as a manure, after all the salts are extracted from soap boilers' ashes, the earth sells for ten cents the bushel, and notwithstanding this high price, it is not unusual for the farmer to pay for the article twelve months beforehand. When ploughed into sterile ground, at twelve loads per acre, it produces great crops of wheat, clover, and other sorts of grass and grain, and its fertilizing operation will last twenty years. Although some of the other ingredients of the ashes left after lixiviation may prove beneficial, yet the effects are chiefly from the cinis, or new named earth.

" This earth, which is so prized in America as a manure, was esteemed of old in Asia, as an ingredient in a cement: among the ancient Syrians, it was one of the materials forming the plaster of their walls; and as it holds an intermediate place between lime and potash, it can easily be conceived how it may act both as

a cement and a manure. It is to be hoped, chemists will turn their attention to this important subject." See Tilloch's Philos. Magazine, Vol. VII. p. 273, for the whole of this interesting letter.

3. *Several metallic Salts promote Vegetation, shewn by the Experiments of Professor* Barton, *of Philadelphia.*

Letter from Benjamin Smith Barton, *M. D. Professor of Medicine in the College of Philadelphia, to Dr.* Pearson, *containing Experiments with metallic Solutions to determine their Effects on Plants.*

SIR,

Philadelphia, Oct. 28, 1802.

IN the *Annals of Medicine* for the year 1801, you inform us, that you have lately read a paper at the Board of Agriculture, " containing an account of the effects of a saline body collected from peat, as a most powerful manure, which turns out to be sulphate of iron; a substance (you remark) hitherto considered to be a poison to plants." This piece of intelligence gave me much satisfaction. I have, for some years, been engaged in an extensive series of experiments, relative to the effects of various stimulating articles, such as camphire, &c. upon vegetables; and on the absorption of certain powerful mineral substances into the organic system of vegetables. In numerous instances I have subjected the stems and leaves of plants, young and old, large and small, to the influence of the sulphates of iron and copper. I have found, that both of these metallic salts are very *greedily* absorbed by vegetables, insomuch that I have detected the presence of iron in the vessels of a branch of mulberry, at the height of five or six feet above the place of immersion in a solution of the sulphate of this metal. A full account of my experiments, I design to communicate to the public in two memoirs. Permit me to observe, in the meanwhile, that the sulphate of iron, applied to vegetables in the manner I have mentioned, " is only (to use your own words) a poison, like almost every thing else, from the over-dose." *In several of my experiments, the branches of vegetables that were placed in vessels containing solutions of the sulphate of iron and copper, lived longer and exhibited more signs of vigour, than similar branches that were placed in equal quantities of simple water.* It is true, that, in many other experiments, these metallic salts proved fatal to my plants; but this was when I employed too

large a dose. In like manner I had found several years ago,* that camphire, by greatly stimulating, often kills vegetables; and yet, when properly dosed, this is a very wholesome stimulant to plants. I had also found, that large doses of nitre (which is unquestionably a powerful stimulant both with respect to animals and vegetables) produce an appearance like genuine gangrene in the leaves of vegetables: and yet it is certain that nitre, when it is judiciously dosed, may be made to greatly assist the healthy vegetation of plants.

Excuse the liberty I have taken in troubling you with these few loose hints, and permit me to subscribe myself, Sir,

your very humble and obedient servant, &c.

BENJAMIN SMITH BARTON.

To Dr. Pearson.

4. *Sulphate of Iron in the Peat of Russia, found by Professor* Robinson.

Something else besides vegetable matter is necessary to form peat or black moss of the moors. The smell of burning peat is different from that of vegetable matter. Peat ashes, says the Professor, always contain a very great proportion of iron; he has seen three places in Russia where there is superficial peat moss, and in all of them *the vitriol is so abundant as to effloresce.* In particular, on a moor near St. Petersburgh, the clods shew the vitriol (sulphate of iron) every morning when the dew has evaporated. According to this learned Professor's observation, the sulphate of iron in pit coal may be accounted for in the following manner: "peat mosses form very regular strata, lying indeed on the surface; but if any operation of nature should cover this with a deep load of other matter, it would be compressed and rendered very solid: and remaining for ages in that situation, might ripen into a substance very like pit coal. See the Medical and Chirurgical Review for November 1803.

* See Transactions of the American Philosophical Society, Vol. IV. No. xxvii.

5. *Mr.* Anstey's *Testimony of the Use of Peat Dust and Peat Ashes.*

SIR,

Houghton Regis, Dec. 3, 1801.

I received yours, dated the 18th of November last, in which you requested me to inform you what experiment I had made from the turf dust, taken from Tingrith Moor. I have made use of the ashes and dust near thirty years, and I frequently lay on from eighty to a hundred bushels per acre. Our land is dry and very thin stapled, owing to the chalk rock laying so very near the surface; it encourages vegetation in moist warm weather; but when hot and dry, the reverse. We never mix any other manure with it. It costs about four-pence per bushel, including all expences.

We chiefly spread it on our seed grass, clover, &c.

I am, Sir, your humble servant.

JOS. ANSTEY.

No. XII.

On Burning Lime with Peat. By Mr. John Dodgson.

GENTLEMEN,

Grahamonset, Parish of Bewcastle, County of Cumberland, Nov. 18, 1803.

I HAVE for some years past practised the burning of limestone with peat, which I find by experience to answer so well, that I have quite laid aside the burning lime with coals, though I am only about two miles distant from the coal pit.

The burning lime with peat is so little understood, that a gentleman published a paper in the Farmer's Magazine (printed by Mr. Constable at Edinburgh), recommending a battering machine to pulverize unburnt limestone, stating the machine to be of the greatest importance, when no other fuel but peat could be obtained, inferring thereby that peats would not burn lime. I wrote against him, proving that I could burn lime cheaper with peat than with coal, &c. My paper was inserted in the November Number, 1802, of the Magazine; the advocate for the battering machine has not yet dared to answer me.

Yours, &c.

JOHN DODGSON.

To the Right Hon. Lord SHEFFIELD *the President, and the Members of the Board of Agriculture.*

MY LORDS,

YOURS of December 6th, from Mr. Young, Secretary to the Board, I duly received, and shall with pleasure give you all the information I can on the subject of burning lime with peat. I occupy a small farm (my own property) in the north-east district of Cumberland, and in the course of ten years experience I find, that in point of comparative expence, quickness of the process of burning lime, &c. that peat in many situations is preferable to coal. As to the expence, a man with a boy to wheel out the peat, will dig as many in one day as will burn fifty or sixty Carlisle bushels of lime (the Carlisle bushel is equal to three Winchester ones). The expence of drying them is not more than the digging, being in the whole about six shillings.

The coal at the pit in our neighbourhood is sold by measure at one shilling per quarter, and costs twelve shillings to burn the same quantity of lime, besides the expence of men and horses, drawing the coal perhaps three or four miles to the kiln. A great advantage in favour of peat when it is within a few yards of the kiln, as mine is.

The quickness of the process with peat is surprising, for in twelve hours after I put fire to the kiln, I have lime ready to draw; in burning with coal, none can be drawn for two or three days; and nearly double the quantity of lime is produced every succeeding day, than can be with the use of coal, owing to the peat keeping the limestones in an open porous state, and admitting a brisk circulation of air; for the same reason the limestones cannot be run into a solid lump, with excessive heat, as sometimes happens with coal.

You wish to know the proportion of peat to stone; of this there is no certain criterion, as peats are not all of the same quality; some stones are also easier burnt than others; consequently two or three days experience in burning is better than twenty pages of description. As stated above, I have peat at half the value I could have coal; in some cases it would be one-third the value of coal, and in some situations even equal, especially when far to drive to the kiln, as peat being a more bulky article than coal, requires more cart loads of it to a given quantity of lime than it would of coals. The wetness of seasons is no objection to peat, as I

find by experience, that peat when about half dry will burn lime as well as when thoroughly dry, only the process of burning is a little slower. Peat may be stacked near the kiln, and burnt when convenient; or if burnt in summer, taken from the ground it is dried upon without stacking. I take no particular care in putting in the peat, only throwing in a layer of peat, and another of stones, taking care to have the lime well burnt: the stones I break no smaller than others in our neighbourhood who use coal.

This district of the county abounds with good limestone. The farmers generally burn their own lime; and even when coal is used, can get it cheaper than purchasing it at the kilns that burn for sale. I lately burnt one hundred and seventy Carlisle bushels of lime with peat, which, besides my own and servants' work, cost me only two shillings, and this work not much more than what the tedious attendance of men and horses would have been at the sale lime kilns. Last summer I burnt two hundred and seventy Carlisle bushels of lime (that is near one hundred quarters ten heaped measures to a quarter) with peat about half dry, and got good lime. I had only five men one day digging peat for the above quantity, the rest of the work was done with women and boys.

I have used lime burnt with peat in building, in compost for meadow land, and for arable land, at the rate of thirty-five or forty Carlisle bushels per acre. I prefer using it upon arable land for a potatoe or turnip crop, when hot or fresh burnt; as I once made an experiment, and found that it had the advantage in the succeeding crops of barley, clover, and oats, than when spread cold.

You would know the form and size of a kiln proper for burning with peat. The kiln I use is what is called a common draw kiln, is not a large one, but is sufficient for my farm.

A kiln should be built on the declivity of a hill to make it easier of access at top, and its foundation easier cut. A decent farm kiln for burning either with peat or coal, should be two and a half feet wide at bottom, and expand gradually to sixteen feet high, and seven or seven and a half feet diameter at top. May be built on a larger scale, but the less diameter at top, in proportion to the deepness, the better.

I should be happy if the interest of agriculture was in the least benefitted by the adoption of the knowledge of my peat burning plan. There is certainly many farms in the United Kingdom that abound with peat-moss and limestone; in this case the farmers might employ the poor of the neighbourhood, and their own servants

and horses, without going off the farm, perhaps ten or fifteen miles to sale lime kilns, with the additional advantage of having their lime cheaper. And in a national point of view, if we consider the great demand for coal, and its exportation from Britain to all parts of the world, certainly that valuable mineral cannot be too much economized, especially if a substitute can be found for it as may be in peat.

Gentlemen, I would not deceive you by insinuating that I am the first, or the only person in Britain that used peat in burning lime; the only district, however, in which I ever heard of its being used, is by Sir William Maxwell's farmers near Dumfries in Scotland.

I had some conversation on the subject some months since with an agricultural gentleman of the name of Maughan, from Hertfordshire, near London, who was in our neighbourhood surveying an estate, the property of George Sumner, Esq.; the use of peat in lime-burning was unknown to him.

Remain yours, &c.

Grahamonset in Bewcastle, County of Cumberland, Dec. 15, 1803.

JOHN DODGSON.

No. XIII.

On feeding Horses. By Mr. Thomas Fisher.

SIR,

Kell House Farm, near Carlisle, Jan. 22, 1801.

As I perceive by the public papers, it is the wish of the Honourable Board of Agriculture to gain and disseminate useful information; and as at this time of dearth it certainly is the duty of every good subject to bring forward any plan which may tend towards the saving of bread corn, I take the liberty, through you, to lay before the Board, a practice which I have some years followed with great satisfaction and benefit; and by which, though my horses do as much work as any farm horses not constantly upon the road can do, as I lead my own coals and lime for manure from the distance of twelve or fourteen miles, yet without using a quarter of marketable oats through the year, they are as healthy, as sleak skinned, as fit for work, and in full as good condition as any in my neighbourhood. My farm is but fifty-three acres, from twenty-three to twenty-seven acres of which are always under the plough, and for working of which, and my saddle, I keep three horses; for which horses I keep a four acre field near the house in constant separate rotation, that I may have green or succulent food for them through the year; that is, one acre each year is a fallow crop with potatoes, set with the plough; a second acre with barley, laid down with fourteen pounds of red clover, and half a Winchester bushel of rye-grass seed; a third acre, clover and rye-grass for summer food; and the fourth acre, wheat (or sometimes for change oats) after clover. Only a small part of the potatoe acre are for the horses, as I have never found it necessary to set more for their winter use than one Carlisle peck, containing six gallons heaped for each horse, of the *black* potatoe, which is not in general liked as human food, is of a hardy nature, not easily injured by wet, and extremely productive; this season was much against the *dunn* or general crop of potatoes. My black, upon the same acre with equal management, were double in product; the three pecks yielding eighty in return, about one-seventh less than the past or former year; they are always

kept in a spare stall in the stable, and clean washed each morning for the day's use; they are preserved from the frost by flakes and sods all round, and are sufficient for the three horses from November till May; each feed must be given *after* their water, twice or three times a day, according to their work, a corn measure full each time, according to the horses size; and now and then, after the turn of the year, when oats are thrashing out, a feed of *binderends* in lieu when hard at work.

The clover I generally begin to cut, from the middle to the 20th of May, before it begins to flower; the acre is divided into three cuttings from top to bottom, by which none but the part cut is trodden upon; it is cut fresh every morning, but if twice a day the better, and given before work, at dinner, and before turning out at night. On Sundays they seldom get any, being out at grass. The clover is always cut twice over, and often three times, and then ploughed in for wheat; but besides this, I have never got less than fifty stone of good clover hay from it, but generally more: this season ninety stone. From the last part of each cutting getting nearly ripe before the horses could eat up to it, I was obliged to cut for its next growth; the horses whilst at clover never taste hay nor oats, save upon a journey, and then we always carry clover. Now, Sir, as I have found this method to answer for seven years past, there certainly can be no risk in recommending it to general farm use. I am fully persuaded, that whoever gives it a fair trial will never leave it off; and should it become general amongst farmers, it is not easy to calculate how much bread corn would be saved to the pub: c, as oatmeal is now more generally used, and in this part of the kingdom has ever composed a material part of the food of children and the poor. Should this plain statement of approved facts be the humble means of bringing such into practice, it will to me prove sufficient reward; and with apologizing for the space I have occupied in your time, so much employed for the public good, I remain with great respect for the Honourable Board,

Sir, your most obedient servant,

THOMAS FISHER.

Arthur Young, Esq.

No. XIV.

Queries relating to Dairies, answered. By John Conyers, *Esq.*

Sir,

Mount Street, Feb. 16, 1803.

I beg leave to submit to the Board of Agriculture, the answers I herewith send to the queries relating to dairies.

I am, Sir, &c.

John Conyers.

Arthur Young, Esq.

Queries relating to dairies.

1. What is your breed of cows?

2. How are they fed in summer, and in winter? and what quantity or breadth of grass, and winter crops do they consume?

3. Are they kept in yards, housed, or abroad?

4. Are they ever fed with green food mown, and with what effect?

5. At what age are heifers sent to bull?

6. At what age is it most advisable to dry cows for fattening?

7. What is the description of cows that are (after milking) the best adapted to fattening?

8. At what age are calves weaned, and in what manner treated?

9. Average product of your cows in butter, or cheese, calf, and hogs?

10. Have any, and what improvements have been made in dairy utensils?

11. Are there any circumstances in the management of your cow pastures which merit noting?

12. Have you any particular methods of manufacturing butter or cheese worthy of communication?

13. How are the skim milk and whey applied?

14. What is the consumption of salt in your dairy?

With the addition of any other information on this subject, which may be conceived useful?

QUERIES.

Q. 1. *What is your breed of cows?*

Ans. The North Devonshire; having found by experience their superiority in every respect over all the others that I have tried. I might prefer the Herefordshire, if my land was firm enough to bear them; but mine, like the land in most dairy countries, is of a tenacious nature, and suffers by the treading of heavy cattle in the wet weather.

Q. 2. *How are they fed in summer and in winter? and what quantity or breadth of grass and winter crops do they consume?*

Ans. This must be regulated by the quality of the pasture; if extraordinary good, one acre will suffice; if moderate, one and a half. A Devonshire cow in milk, during the winter months, consumes about *one ton of hay, or rather less.*

Q. 3. *Are they kept in houses, or abroad?*

Ans. Certainly best kept in houses, whilst any fodder is given.

Q. 4. *Are they ever fed with green food mowed, and with what effect?*

Ans. This, like most other dairy countries, produces very little green food, except the natural grass, and this is never mown green for fodder.

Q. 5. *At what age are heifers sent to bull?*

Ans. One of the greatest evils attending a dairy farm is, that of the cows slipping their calves, which is much occasioned by the heifers being sent too early to bull. Mine do not go to the bull before they are three years old.

Q. 6. *At what age is it most advisable to dry cows for fattening?*

Ans. I think this a most important consideration. I have observed in this, and most other dairy countries, the practice is to continue milking or suckling a cow till her constitution is so exhausted, that no power of fattening is left, and her flesh is then no better than carrion. In the vicinity of London, I am told, the Jew butchers purchase the cows that have been so worn out, at very low prices, to make sausages of. It is difficult to say precisely at what age a cow should be dried, as it must depend in some measure in the constitution of the animal; but on an average, I think, between the ages of seven and nine.

Q. 7. *What is the description of cows that, after milking, are the best adapted to fattening?*

Ans. The North Devon.

Q. 8. *At what ages are calves weaned, and in what manner treated?*

Ans. Calves are weaned from the time of their birth, such only being taken for

that purpose as are calved early in the winter, so that they may be of an age to graze, as soon as there may be any grass in the spring; they are usually fed by hand with skim milk and warm water; mine have an infusion of hay in the water.

Q. 9. *Average product of your cows in butter or cheese, calf, and hogs?*

Ans. Upon an average ten cows give five dozen pound of butter, per week in the summer, and two dozen in the winter. A good North Devon cow fats two calves a year. My thirty North Devon cows have this year, upon an average, produced (a profit of) thirteen pounds fourteen shillings per cow.

Q. 10. *Have any, and what improvements been made in dairy utensils?*

Ans. None.

Q. 11. *Are there any circumstances in the management of your cow pastures which merit noting?*

Ans. The management of a cow pasture, I conceive, does not differ from that of any pasture applied to other uses; it consists in not suffering any stagnate water to remain on the surface, or the land to be poached by the treading of heavy cattle in the wet season.

Soap ash seems to be the manure which produces the sweetest sort of herbage. The wild carrot is the only weed I am acquainted with, which is pernicious to the taste of butter. It is on the old pastures only that the best butter is made.

Q. 12. *Have you any particular method of manufacturing butter or cheese worthy of communication?*

Ans. None, but what is generally known; extreme cleanliness is required in every part of it.

Q. 13. *How are the skim milk and whey applied?*

Ans. Either to the fattening of porkers, or to the disposing of it at the rate of three-pence per gallon to the lower classes of the people, or to the taking of pigs to keep at the rate of from three shillings and sixpence to four and sixpence per week. I have known a hog fatted to the weight of sixty-six stone, without the offal, at eight pounds to the stone, fed only upon skim milk.

Q. 14. *What is the consumption of salt in the dairy?*

Ans. One pint per week for the cream of ten cows.

With the addition of any other information which may be conceived useful.

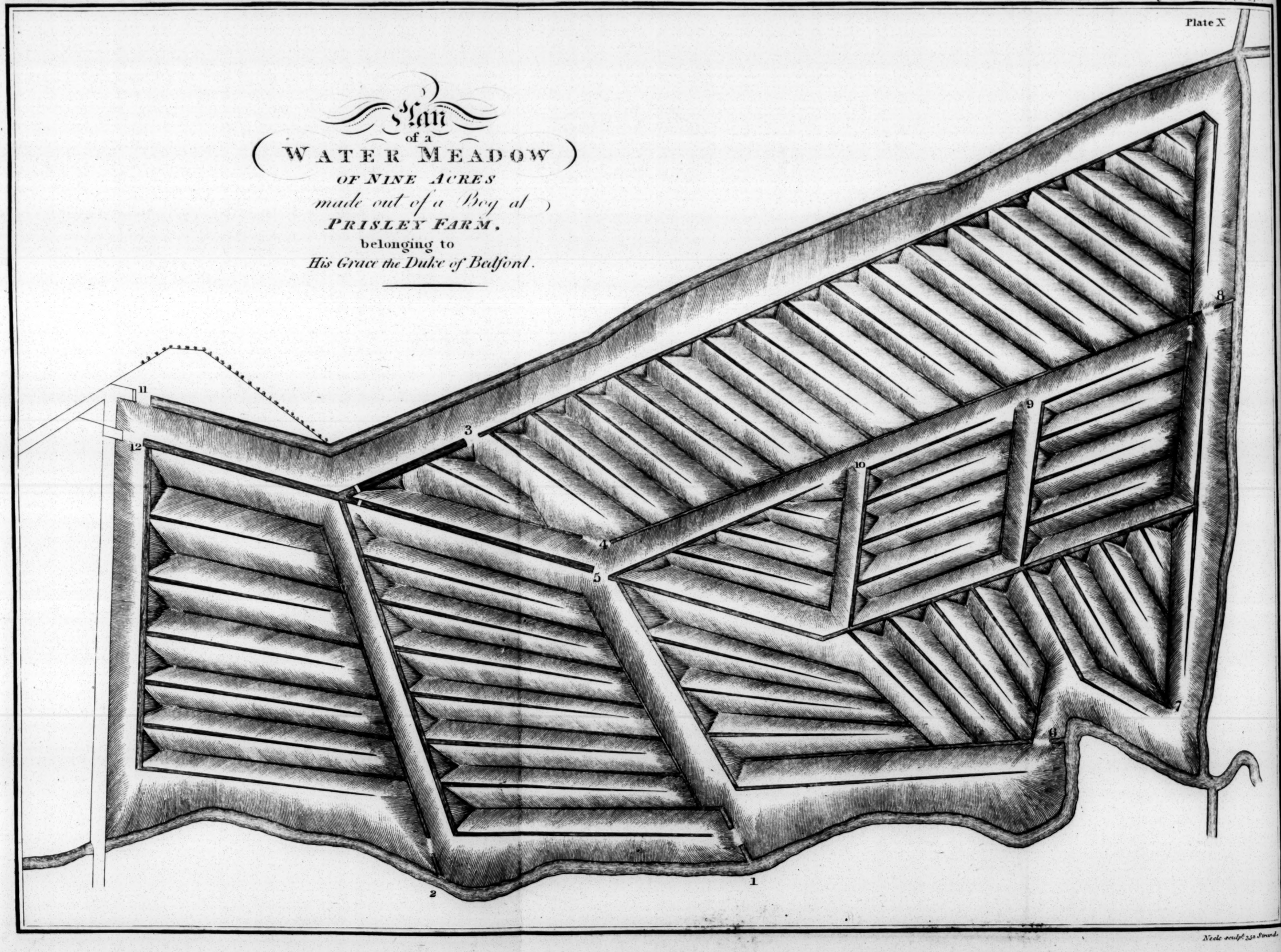
From my observations on the management of dairy farms, it appears to me that much loss to the public, and to the farmers themselves, is sustained by the produce of the cow in butter, cheese, or veal, being the only objects of consideration; it is

difficult to say what may be the amount of, but it must be very considerable the meat that is wasted by negligence in procuring these articles. The management of a dairy being a matter of too much importance to be intrusted to the care of a servant, the fatigue of it generally falls upon the farmer's wife or daughters; the consequence of which of late years has been, that the use of the dairy has been much set aside, and the suckling of calves for veal substituted in its place. When this happens, the profits from the farm are diminished, the cows so employed are more rapidly worn out than those used for milking, and the neighbourhood, particularly the lower classes of it, suffer much from the deprivation of skim milk for their families, or the means of fattening their pigs, by paying a weekly sum for the keep of them. No one, except those who have witnessed it, can conceive what an encouragement the latter practice is to the frugal and industrious husbandman; and if farmers would dispose of their skim milk in this manner, more generally than they do, instead of contracting with pork butchers for the sale of their pigs, they would find their profits full as great, and they would eventually conduce to the lowering of their poor rates. Less butter being made than usual, owing to the circumstance I have mentioned, and the great expences attending a dairy, I conceive must contribute to the cause of that article increasing so much in price; but the management of a dairy, I believe, to be open to much economy. The consumption of fuel is an object of great consideration; and could the dairy farmers be prevailed upon to use coal instead of wood, and be made acquainted with the improvements lately made in the fire-places for burning the former, they would soon be sensible of the advantages of it; such a practice is the more desirable, because it would be the means of the pollard trees being eradicated from, instead of being encouraged in the hedges. The value of the hay which milch cows consume in the winter, is a great deduction from the profit of the dairy. No effectual substitute for it has, I believe, been hitherto discovered. It is not till the second week in May there is usually natural grass enough for the cows to subsist on; but this evil is likely to be alleviated by the introduction of what is known by the name of the cow grass, which certainly appears to possess all the advantages of clover without any of its dangerous consequences, and is getting to be much cultivated; the difficulty of ascertaining whether the seed is genuine at the time of purchasing it, is the only impediment I know to its becoming more generally used.

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Plate X

Plan
of a
WATER MEADOW
OF NINE ACRES
made out of a Bog at
PRISLEY FARM.
belonging to
His Grace the Duke of Bedford.



Neele sculpt. 350 Strand.



No. XV.

Crop of a watered Meadow, of Nine Acres, at Priesley in Bedfordshire.*

Communicated by His Grace the Duke of Bedford.

1803, March 29. Stocked with twelve score of sheep, and it kept them three weeks.

April 16. Shut up for hay.

June 23. Cut the first crop of hay, supposed to be above two ton per acre.

Aug. 20. Cut the second crop, supposed to be one ton and a half per acre.

Sept. 16. Stocked it with four score of fat sheep; three weeks after that, it was pastured with lean bullocks, as long, and as often, as they could find food.

1804, Feb. 27. Stocked it with eight score and four lamb hogs; they have now (April 28.) been nine weeks in it.

It had more and better water this last winter, than the winter before; but from our want of grass upon the farm, we have eaten it longer than should have been done.

Valuation.

	£.	s.	d.
1803, March 29. 240 sheep three weeks, at 6*d.* per week -	18	5	0
Spring food per acre £2.			
June 23. 18 tons of hay, at £4. - - -	72	0	0
Aug. 20. 13½ tons ditto, at £4. - - - -	56	0	0
Sept. 16. 80 fat sheep three weeks, at 4*d.* - -	4	0	0
Lean bullocks - - - - - -			
Per acre £16. 13*s.* 8*d.*	150	5	0
1804, Feb. 27. 164 hog-sheep nine weeks, at 5*d.* - -	30	15	0
Spring food per acre £3. 8*s.* 4*d.*			

* A farm occupied by his Grace the Duke of Manchester, who formed this meadow.

No. XVI.

Experiment on Wheat. By R. P. Anderdon, *Esq.*

To the Right Hon. Lord Sheffield, President of the Board of Agriculture.

My Lord,

I had the honour to receive from Lord Carrington, when President of the Board, a paper signifying the Proceedings of the Society, May 27, 1802, and proceeded to make the following experiment on wheat; the produce of the respective perches dibbled I shall distinguish numerically by numbers from one to twelve, being the whole number of perches on which this experiment was tried.

The experiment was made, as much as was possible, under my own inspection, on a heavy loam rather inclinable to clay, the whole field being properly manured and prepared for a wheat crop, and drilled with wheat in single rows, two feet and a half asunder, for horse-hoeing, except that part of it set aside for the dibbling.

The sort of wheat was what is here called white-knot, and dibbled the 4th Nov. 1802, with five pints and a half of seed, all on the same day, and reaped the 1st August, 1803.

The following is my bailiff's account of the produce, which I believe to be perfectly accurate.

Two grains in each hole.

	Produce.				Produce of	
	Corn.		Weight.		corn per acre.	
	Pecks.	Pints.	lbs.	oz.	Bushels.	Pecks.
No. 1,	1	5	21	5	52	2
2,	1	5	20	15	52	2
3,	1	3	17	10	47	2
4,	1	5	19	13	52	2

Three grains in each hole.

	Pecks.	Pints.	lbs.	oz.	Bushels.	Pecks.
No. 5,	1	4	19	13	50	0
6,	1	1¼	17	0	43	0½
Four grains in each hole.						
7,	1	2½	18	10	46	1
8,	1	2¾	18	12	46	3½
9,	1	2¼	18	4	45	2½
Two grains in each hole.						
10,	1	5	21	4	52	2
11,	1	3¾	19	7	49	1½
12,	1	1½	17	4	43	3

I am to observe, my Lord, that, on the 5th April, 1803, on the three perches, No. 10, 11, 12, where both plants grew, which was generally the case, one of them was drawn when the seminal root was decayed, and the plants had tillered.

On the 30th April the whole was weeded, when these three perches looked the greenest of the dibbled wheat, but not nearly so green as the wheat in the same field, which was drilled and had been horse-hoed three weeks before that time.

The produce of this dibbled wheat, by far exceeds the quantity of any crop I have ever known in this neighbourhood put into ground in any other method; but the harvest last year was hereabout more abundant than ordinary, though not equal to the crops in 1802.

I have the honour to be, &c.

Henlade, May 16, 1804. RT. PROCTOR ANDERDON.

No. XVII.

Account of a Cottager. *By Sir* William Pulteney, *Bart.*

My Lord, Shrewsbury, January 3, 1805.

I have been informed since I came here, of the practice of a cottager in the cultivation of a small portion of ground, which if generally practised would, I think, add much to the support and comfort of that valuable class of our population, and I have thought I should contribute to the general welfare, by communicating it to the Board.

Within two miles and a half of this place, a cottager, whose name is Richard Millward, has a house, and adjoining to it a garden and land, making about one acre and one-sixteenth of an acre, including the garden. It was formerly taken from Pully Common, since divided and inclosed. He is a collier, and the management of the ground is, in a great measure, left to his wife Jane; they have six children alive, five boys and one girl, and have buried five. The soil of this ground, when inclosed by the cottager long ago, was a thin covering of about three or four inches of strong loam over a clay, impregnated with iron, called in Shropshire cat-brain, and considered as the worst soil. It is now changed, but the original soil is still to be seen in the adjoining parts of what was the common. They pay three shillings of yearly rent for the house and land; it was leased to them thirty-eight years ago, by the present Lady Malpas, for three lives, one of which is dead.

This woman has managed the ground in a particular manner for thirteen years with potatoes and wheat, chiefly by her own labour, and in a way which has yielded good crops, and of late fully equal, or rather superior, to the produce of the neighbouring farms, and with little or no expence; but she has improved her mode of culture during the last six years.

The potatoe and wheat land, exclusive of the garden, contains sixty-four digging roods or poles, eight yards square to the pole, seventy-five of which make an acre, and is divided in two parts; one is thirty, the other thirty-four roods. One of the divisions she plants alternately with potatoes, and the other is sown with wheat, on

the wheat stubble; she plants potatoes in rows, and sows wheat on the potatoe ground; she puts dung in the bottom of the rows where she plants the potatoes, but uses no dung for the wheat; and she has repeated this succession for nearly the thirteen years, but with better success and more economy during the last six or seven years.

She provides manure, by keeping a pig, and by collecting all the manure she can from her house, and by mixing with it the scrapings of the roads, &c. She forms it in a heap and turns it, before she puts it on her ground for potatoes.

The ground is dug for potatoes in the month of March and April, to the depth of about nine inches. This digging would cost sixpence per rood or pole, if hired. After putting in the dung, the potatoes are planted in rows, about twelve or fourteen inches distant. The sets are placed about four or five inches apart in the rows.

The dung is carried out in a wheelbarrow, and it takes a great many days to plant the whole, generally ten days.

Her husband always assists in digging, after his hours of ordinary labour. When the potatoes come above ground, the weeds are destroyed by the hoe, and the earth laid up on both sides to the shoots, and this is repeated from time to time, as the season requires. Hand-weeding is also used when necessary.

In the month of October when the potatoes are ripe, she takes off all the stalks or haulm of the potatoe, which she secures to produce manure by means of her pig. She now goes over the whole with a rake, and takes off all weeds, and before taking up the potatoes she sows her wheat on as much of the ground as she can clear of potatoes that day. They are taken up with a three-pronged fork, in which her husband assists, and by the same operation, the wheat seed is covered deep. She leaves it quite rough, and the winter frost mellows the earth, and by the earth falling down it adds much strength and vigour to the wheat plants in the spring. Her crops of wheat have been of late always good, and even this year, which in this country has not been favourable for the wheat crop, she has thrashed out fifteen Winchester bushels from her thirty-four roods or poles, though part of her wheat has suffered by the mildew. The average of wheat in moderate years to her near neighbours, is twenty-eight Winchester bushels per acre, which is more than the general average of the county, being near the town dung. The straw of her wheat she carefully preserves for litter to her pig, and to increase her manure.

When her potatoes are gathered, she separates the best for use, then a proper

quantity for next year's seed, and the small sort are given to her pig. She has sixteen roods or poles for her garden, upon which she plants peas, beans, and a part with cabbages; but has early potatoes and turnips the same year on the same ground. She sells her early potatoes and peas and cabbages at Shrewsbury, and boils the turnips for her pig. The only other expence of feeding her pig, is two or three bushels of peas, and when fit to kill, it weighs about three hundred pounds. She buys it at the age of four or five months, about the month of February, and it is killed about the month of January of the following year.

When she first began this method of alternate crops, and for several years after, she depended on the neighbouring farmers for ploughing the land and harrowing, both for the potatoes and the wheat; but as the farmers naturally delayed to work for her, till their own work was chiefly over, her land was not ploughed in proper time, or season; she has been now for the last six years independant of the farmer, and the planting the potatoes, and the mode of taking them up, is sufficient to prepare the land for wheat, which she generally sows herself about the middle of October, being careful to sow no more land at a time, than she can clear of potatoes that day.

This mode of culture proves, that both potatoes and wheat can be produced alternately upon the same land for a long course of years, provided, that a small quantity of manure be every year used for the potatoes, and it shews that a cottager may procure food from a small portion of land by his own labour, without any expence or assistance for labour.

Both wheat and potatoes have been reckoned in the class of exhausting crops; but this mode of culture shews that great crops of both may be long alternately produced, which may probably be imputed to the culture by the spade and hoe, to the manuring every second year for potatoes, to the careful destroying of weeds, to the planting and sowing in the proper season, and to the preventing the earth from being too loose, by the mode of sowing the wheat before the potatoes are taken up.

An experienced farmer is of opinion, that the same culture and succession of crops will answer on almost any land, if properly drained and skilfully managed; for that although strong land does not answer well for potatoes, nor very light land for wheat, yet that cultivation and manure, and particularly the manure of lime, will soon render strong land, when drained, more loose, and will make light land more firm, especially if cultivated with the spade and hoe.

I am, &c.

Lord Sheffield, P. B. A. WILLIAM PULTENEY.

No. XVIII.

An Account of the Result of an Effort to better the Condition of the Poor in a Country Village: and some Regulations suggested by which the same might be extended to other Parishes of a similar Description. Presented to the Board of Agriculture by Thomas Estcourt, *Esq. M. P.*

THE parish of Long Newnton contains one hundred and forty poor persons, of all ages, divided into thirty-two families, chiefly employed as labourers in husbandry. In the year 1800, an idea suggested itself, that these poor people would voluntarily exchange their claims to parochial relief, for any other aid suitable to their habits, that would yield, with their labour, a better prospect of procuring the common domestic comforts of life. They were frequently consulted on the subject, and were informed that it was anxiously desired to remove them, if possible, out of the reach of the recurrence of distresses, similar to those they had lately felt; that they should be furnished with the means, if they would endeavour to make a proper use of them; that it should be at their own option to accept the offer that would be made them, or not; but they were advised to make an effort to extricate themselves from that depth of extreme poverty into which they were sunk. It was then proposed that each cottager, on his application for the same, should become tenant of a small quantity of arable land, under proper restrictions, and at a fair rent, but that no person should be allowed to occupy more than the family of such person could cultivate, without improperly interfering with his usual labour, nor more than he could procure manure to keep in a state of high fertility; that the largest families should not, therefore, occupy more than one acre and a half, the smaller families less, in proportion as their numbers were fewer, and not likely to increase.

That the rent of the land should be at the rate of £ 1. 12*s.* per acre.*

That one-fourth part of the land in each person's occupation, should annually be well manured in rotation, and planted with potatoes; that the remainder should be

* It was never known before to bear more than twenty bushels of wheat to an acre, under the best cultivation, and would let to a farmer at about 20*s.* per acre, now.

managed as the tenant should think proper, except that no person should have two exhausting crops of corn (viz. wheat, barley, oats, rye) successively.

That the land should be forfeited to the landlord, if not cultivated and manured as abovementioned; or if the tenant should be lawfully convicted of felony, or any other offence against the law, for which he would be liable to a fine, or imprisonment.

That it should also be forfeited, if the tenant should receive any relief from the poor-rates, except medical assistance, and except such relief as the family of any tenant should receive, under the authority of any law relating to the Militia, or any other Act of Parliament that might afterwards pass, of a similar description, for the defence of the country.

That the land should be granted, if required, for a term of fourteen years; but the lease, or agreement, should be void, by either party giving the other three years notice of such avoidance.

This was the offer made to them. They entered warmly into the idea; promised every possible exertion on their part to give it success; and all accepted the offer, except two widows with numerous families of young children, and four very old infirm persons without families, who had not then courage to make the experiment.

The high price of provisions at that time, notwithstanding they all had a very liberal allowance from the poor-rate, had ran them so much in debt for the common necessaries of life (chiefly for bread), that it being deemed essential to their success that they should be freed from these incumbrances, money was advanced on loan amongst them, in proportion to their wants, amounting to the sum of £44.

At Lady-day, 1801, each person entered on the first part, or one-third, of the land allotted to him; at the Lady-day, 1802, they entered one-third more; and at Lady-day, 1803, on the remainder.

The great effect of this easy mode of supplying their wants has already produced in their habits, morals, manners, and condition, will be best proved by a statement of a few facts that have resulted from it.

The only persons who have received any relief from the poor-rate of this parish, since Michaelmas, 1801, are the four old infirm persons beforementioned (two of whom are since dead), and the two widows with large families. The two widows, rather than go with their families to a workhouse, have since requested to be put on

a footing with their neighbours; and they also have received no relief since Michaelmas, 1803, when their first crop came into use: one of them has six, the other eight, small children, the eldest not twelve years of age. No person has forfeited his land; but three single men have asked leave to resign theirs, being able to subsist very well by their labour. Except these, they have all strictly and cheerfully adhered to every part of the agreement by which the land is held. There is one circumstance particularly gratifying, observable in the operation of this plan, which is, that those poor persons who have the largest families, and were the heaviest charge to the parish, are those who seem to set the highest value upon their land, and cultivate it with the greatest assiduity, and therefore the most anxious to avoid in future doing any act by which it would be forfeited. This may arise from the pleasure the parents feel in seeing their numerous children well provided with every comfort requisite to health and subsistence, independent of every one but themselves, and a source of happiness, instead of anxiety and despair. Fruitful seasons, and a neat garden-like cultivation of the land, has hitherto rendered it highly productive. Great attention is paid to collecting manure, of which every one is able to provide amply for the land he occupies: the hoe is actively employed to keep the crops clean from weeds in the summer by the women and children, who also perform the greatest part of the harvesting, and other labour, except the tillage, and carriage of the produce and manure: the tillage is partly performed by the spade, and is done by the family, or hired. If the land is ploughed, it is done partly by the ploughs of the farmers of the parish, gratis, or hired; the carriage the same, or is sometimes done by a wheel-barrow only. They have long since discharged the debt of £44. as well as all other debts, and are so much beforehand with the world, that it is supposed that it must be some calamity still more severe than they have ever yet been afflicted with, that would put them under the necessity of ever applying for relief to the parish again.

Some persons have conceived that inconveniences would arise out of this very circumstance of their being in a better situation in life than formerly; that it would put them above the necessity of labour, and would render them idle, insolent, and immoral; to which it may be answered, that, having given up all claim to parochial relief, they feel themselves obliged to look forward, and to provide against occasional distress, which stimulates them to increased industry and economy; besides which, if, with a numerous family, by the occupation of one acre and an half of

land only, they can obtain more than a bare subsistence, it must be by very superior exertion and frugality; and it is not likely that what is so obtained, will be spent by the same person in vice and extravagance; in fact, three years experience proves to the contrary.

The farmers of this parish allow they never had their work better done, their servants more able, willing, civil, and sober; and that their property never was so free from depredation as at present. It may not be improper to mention, that no warrant has been issued against any poor person of this parish, since A. D. 1800.

Although the keeping a cow has justly been deemed a very beneficial practice to a poor family, yet as it is attended with some difficulties in certain situations, it was deemed right not to make it a necessary part of this experiment; but as the poor are frequently discouraged from economical practices, on account of not being able to employ to advantage any small sum of money they may save, it was proposed, in this case, that if any person could buy a cow, it should be taken in to joist (or tack, as it is there called) at £5. 4*s*. per annum: one of these men has already purchased two cows. On his wife being asked how he had been able to accomplish it, she answered, that her family had always lived the same in times of plenty, as they were obliged to do in times of scarcity; and being known to be a prudent, sober, hard-working family, of good character, it is probable they must have been worth money, even during the late time of scarcity, when he was receiving relief from the parish in the same proportion as the others. The circumstance is mentioned here, chiefly with a view to show how liable the system of relieving the necessitous poor with money indiscriminately, is to corrupt their morals, and to seduce even the well disposed into fraudulent habits; but which, it is hoped, this plan, of rendering a resort to the poor laws for relief unnecessary, is calculated to counteract.

The others are mostly looking forward with eagerness to being able to purchase a cow: their only live-stock at present is hogs and poultry.

The reduction in the amount of the poor-rate of the parish since this plan has been adopted, may be worth stating, though it is admitted that much must be attributed to the difference in the price of provisions at the two periods undermentioned.

The amount of the poor-rate from October 5, 1800, to April 5, 1801, the last six months before this plan took effect, was £212. 16*s*. of which sum £206. 8*s*. was applied to the relief of the poor.

The amount of the poor-rate from October 5, 1803, to April 5, 1804, the last corresponding six months, was £12. 6*s*. of which £4. 12*s*. 6*d*. only was applied to the relief of the poor.

They are allowed medical advice by the parish, and to send for the surgeon when they want him. The amount of the surgeon's bill for the year ending April 1804, amounted to 2l. 8s. only, which will probably be deemed a sufficient proof that this plan is not injurious to health. The £4. 12*s*. 6*d*. was charged for the maintenance of the two poor old persons before mentioned, who are still living, and are not tenants of any land.

This account will conclude with one further observation. This plan and the following proposal for bettering the condition of the poor, does not effect to be founded solely on principles of benevolence to the poor, or to give them any thing, but to embrace the interests of the superior classes also. If, however, charity alone had been the object, it may perhaps be going not too far to observe, that one of the best species of charity is that which enables the poor man to exert with effect, and with honest freedom, that strength, and those faculties, which Providence has blessed him with, for the benefit and support of his family.

If this plan should be approved, it might be carried into execution under the following system of regulations, which would, it is presumed, tend greatly to better the condition, reform the morals and habits, promote the happiness, and increase the industry of the poor, in those parishes where it is capable of being adopted, that is to say, of those which are not situated in cities, or other large towns, and effectually to reduce the poor-rate in such parishes.

That every person who shall provide and let by lease, or agreement in writing, to any poor person, for any term of not less than three years, any dwelling-house or houses, or a part thereof, and shall let so much land with any such house, as that the produce of the labour the family of the person renting and inhabiting it shall be reasonably capable of performing, together with the produce of such land when duly cultivated, shall yield an income sufficient for the proper maintenance of such family, in the opinion of the officer herein-after called the Cottage Warden (which opinion shall be signified by his signing the lease or agreement under which such house and land shall be so let), shall be entitled to receive out of the poor-rate annually, as a reward for, or in respect of every person of such family inhabiting such house, the sum of 20*s*. each, so long as such persons, for or in respect of

whom the same shall be demanded, shall continue to inhabit such house, and who shall have generally inhabited the same during the year for which it shall be so demanded; except that such rewards shall not be payable in the following cases; that is to say, no person shall be entitled to any of such rewards, unless the dwelling-house so let shall be, in the opinion of the Cottage Warden, substantially built, and in good repair and roomy enough for its inhabitants, consistent with health and decency; nor shall it be payable for any person who shall have received, relief from the poor-rate for the last year, preceding the time that such reward shall be demanded, nor for or in respect of any person who shall have, or any one of whose family living with him or her, shall, during the like time, have been lawfully convicted of any felony or midemeanor, for which the culprit may have been liable to fine or imprisonment; nor for or in respect of any child born out of wedlock, of which any person inhabiting such house shall be the reputed father or mother; nor for or in respect of any person inhabiting any house, the person renting which shall occupy premises of the value of 10l. per ann. or more; nor for or in respect of any person whose last legal settlement shall be at that time in any other parish; nor for or in respect of any person in good health, between the ages of fourteen and sixty; nor for or in respect of any person possessed of any permanent income, or who shall carry on, as a master, any trade, manufacture, or profession, the produce of which income, or the clear profits of which trade, manufacture, or profession, shall be estimated by the Cottage-Warden, or Justices, to be sufficient for the proper maintenance of such person, and of his or her family: nor shall any person be entitled to any larger sum, in any one year, on account of such rewards, than such person's share of the poors-rates shall have amounted to for the year for which such rewards shall be claimed, except that if any tenant occupying lands in such parish, the property of some other person, shall not so provide and so let dwelling-houses and lands therewith, sufficient to entitle such tenant to rewards, equal to the amount of his or her poor-rate for the year: then the landlord of such tenant, having so provided and let such dwelling-houses and land, shall be entitled to so many rewards, on the same account, as shall be equal to the difference between the amount of said tenant's rewards and poor-rate for the same year; and if such tenant shall rent of two or more landlords, those of whom such tenants shall rent to the greatest amount, shall always have a prior claim to such rewards before other landlords of the same tenant.

If any person shall receive any reward on account of any poor person, and if it shall appear that the last legal settlement of such poor person was during the time for which such rewards were demanded in some other parish, then the person who shall have received the said rewards, shall re-pay the same to the Overseer for the time being, on its being demanded by the Overseer; and, on refusal, the same may be recovered by action of debt.

The persons who shall be deemed part of the family of any poor person, shall be those who, if not able to maintain themselves, such poor person might, if of sufficient ability, be obliged by law to contribute to maintain.

That there shall in future be, in every parish where there shall be any dwelling-house, so let to any poor person, an officer called the Cottage-Warden, who shall be the resident Minister of the parish for the time being, if there shall be any such resident Minister, unless any other person shall be appointed to the said office, as herein after mentioned; but the Justices of the district, at their Easter Petty Sessions, when there shall be no resident Minister in any parish, or if the resident Minister shall decline to accept the said office, or if such Justices shall see any other sufficient cause, may appoint some principal inhabitant of such parish, willing to accept the same, to the said office; and if there shall be in any such parish no principal inhabitant who shall be willing to accept the said office, then the Justices may appoint any proper person in some adjoining or neighbouring parish, to the said office: And it shall be the duty of the Cottage-Warden to examine the state of repair and condition of such dwelling-house, and the quantity, quality, and situation of the land so let therewith, and shall endeavour to form a proper judgment, whether the same is let at a fair and reasonable rent; and if he shall find that to be the case, and if, upon considering all these circumstances, it shall appear to him that the house so let will be a proper and sufficient habitation for the family of the person renting the same, and that the produce of the land, when properly cultivated, together with the produce of the labour of such family, will probably be sufficient for their maintenance, and that the last legal settlement of such poor person is in the said parish; and if, on the lease or agreement under which such house and land shall be so let being read over to both parties in his presence, they shall mutually acknowledge themselves to him satisfied with the covenants contained therein, and that they have signed the same, then he shall sign his name to the said lease or agreemement. It shall also be the duty of the Cottage-

Warden, from time to time to visit the said dwelling-houses so let within his parish and to inquire into all such particulars as may entitle, or not, the persons letting the same, to such rewards as they may respectively claim on that account; and such rewards as shall appear to him to be due, he shall order to be paid by the Overseer out of the poor-rate. It shall also be the duty of the said Cottage-Warden to attend the Petty Sessions of Appeal herein after mentioned, if he shall have notice of there being any such Appeal, and shall, if required, answer to any questions relative to the same, that may be put to him by such Justices upon oath, to the best of his knowledge, judgment, and belief.

That any two Justices acting for the district may and shall, on the application of the Cottage-Warden to them, appoint some person to act as his assistant under his orders, which assistant shall and may do and execute, under his direction, any thing which such Cottage-Warden is authorized or required to do, except signing the said lease, and except determining whether such rewards are due or not, or settling any disputes that may arise between parties. The Cottage-Warden, or his assistant, shall be entitled to receive annually, on account of every house so let (the lease of which shall be so signed by the Cottage-Warden), from the person letting the same, the sum of 5*s*. as a salary for his trouble; and it shall be sufficient if such assistant shall appear on behalf and instead of the Cottage-Warden, at any time and place where he ought otherwise to appear in the execution and in pursuance of these regulations.

The Cottage-Warden, or his assistant, shall every year, in the month of January, call a meeting of such persons as shall claim such rewards, by giving notice thereof in the church, immediately after or during the time of divine service in the church, on some Sunday at least four days before such meeting shall take place for the payment of such rewards as shall be by him determined to be due, and the same shall become due the 31st December in every year; and if the Cottage-Warden, or his deputy, shall neglect or refuse to call such meeting, by giving such notice, or if such meeting shall not be attended by him, or his assistant, he shall forfeit the sum of £5. and he shall then call such meeting in the month of February, under the like penalty, and so on from month to month, till such meeting shall be held; and the Overseers, or one of them, shall attend such meeting, and pay such rewards, under the like forfeiture of £5.; and the said rewards, in case the Overseers shall not so attend and pay the same, shall be levied by warrant of distress

on their goods and chattels, except that they may withhold those rewards, against the payment of which they shall at such meeting, give notice of Appeal to the Justices in Petty Sessions, as herein-after-mentioned, until such Appeal shall be determined.

Where there are several townships, hamlets, or tithings, in the same parish, the Justices may appoint one Cottage-Warden, and one assistant, to each separate township, hamlet, or tithing.

Where any dispute relative to the performance of any covenant contained in any lease by which any such house and land is held, shall arise between the persons letting, and the poor persons renting the same (such lease being signed by the Cottage-Warden), the same shall be settled by the Cottage-Warden of the parish for the time being, where the same is situated, with an appeal from his determination to the Justices of the district at their Petty Sessions.

No poor person, nor any of his family living with him, who shall be in the occupation of any house and land, the lease or agreement of which shall have been signed by the Cottage-Warden, shall receive any relief from the Overseer of the Poor, out of the poor-rate, without the consent of the Cottage-Warden, or without an order from a Justice of the Peace, granted under his hand and seal; nor shall any Justice grant any such order without oath being made before him, that application has been made to such Cottage-Warden for his consent to such relief being granted, which has been refused.

If the Cottage-Warden shall refuse to sign any such lease, either of the contracting parties may complain to some Justice of the district, who may thereon summon the Cottage-Warden, or his assistant, before the next Petty Sessions that shall be held for such district, to shew cause why such lease should not be signed; and the Justices at such Petty Sessions, or any two of them, may sign such lease, after hearing the merits of the case, if they shall think proper; and the person letting any house and land under such lease, shall, if the same shall be so signed, be entitled to the same rewards as though such lease had been signed by the Cottage-Warden.

If any poor person renting any dwelling-house, the lease of which shall have been signed by the Cottage-Warden or any of his or her family, shall do any act by which the person letting the same would be deprived of any of the above rewards that would be otherwise due to him or her, the lease or agreement of such house

and land shall be forfeited, and such tenants may be removed out of such house by order of a Justice of Peace, directed to the constable of the parish.

The Justice of the district shall hold a Petty Sessions before Easter every year, to hear Appeals from the determination of the Cottage-Warden, and shall issue precepts to that effect to the High Constable, twenty days before such Petty Sessions shall take place, and the High Constable shall give notice thereof to the Constables fourteen days before such Petty Sessions shall take place, and the Constables shall give notice thereof to the Cottage-Warden, and in the church after divine service, on the next Sunday after receiving the same from the High Constable; and any High, or other Constable, failing to give such notice, shall forfeit £5. to the person informing, to be levied by distress.

Any person who shall feel aggrieved by the determination of such Cottage-Warden, may appeal to such Justices of the Peace as shall be assembled at such Petty Sessions as shall be usually held for the determination of such Appeals; and if no such Petty Sessions shall be held, or if no such notice of the time and place of holding the same shall be given in the church, then such person may appeal to any other Petty Sessions, in the same year, for the said district, and such Justices in Petty Sessions shall determine finally whether the rewards so claimed are due, and ought to be paid or not, and shall order accordingly; and any Overseer refusing to pay such rewards as he shall be ordered to be paid by the Justices, shall forfeit the sum of £5. for every reward so refused to be paid, which penalty shall be levied on his goods and chattels by warrant of distress, half of which penalty shall be paid by the person making such Appeal, and half towards the discharge of the poor rate*.

* Instead of limiting the extension to parishes not situate in cities, boroughs, and market-towns, it might be limited by either of the following means:

If the Legislature should deem it a subject worthy its interference, it might declare that these rewards and regulations shall not be extended to, or payable in, any parish, unless application shall be made to the Bench of Justices at the Michaelmas Quarter-Sessions by petition to such Justices from the majority of such of the payers to the poor-rate of such parish as shall be assembled in vestry, requesting them to order that the same may be so extended; and which order such Justices shall grant, if they shall think proper: or the Bench of Justices may be empowered, on receiving such petition, to order that such regulations and rewards shall not be extended to be payable in such parish, if the Bench shall be of opinion that such parish is so situated, that such rewards would not be beneficial to it, or that such regulations would not be practicable in it; or, lastly,

it may be still more limited, to those parishes only who may apply, either separately or jointly, to the Legislature, by private bill, praying that the same may be extended to such parishes, and defining the powers that may be required, in the same manner that parishes or districts are empowered to erect workhouses, &c.

If the preceding account, and the regulations which follow, for encouraging the extension of similar efforts to improve the condition of the labouring poor, should induce persons of ability equal to the task, to turn their minds to the subject, something might be expected, more worthy the attention of the public than these few pages contain ; and the person who drew it up, would be highly gratified to see it in the hands of those who are capable of doing it justice.

No. XVIII.

Observations on the Means of enabling a Cottager to keep a Cow, by the Produce of a small Portion of arable Land. By Sir John Sinclair, ***Bart. M. P. Drawn up for the Consideration of the Board of Agriculture and internal Improvement.***

In several parts of the kingdom, as in Lincolnshire, Rutlandshire, &c. which are calculated for grazing, it is not unusual, to give industrious cottagers as much land as will enable them to keep a cow, and sometimes two, or more, besides other stock; and it appears from the communications of Lord Winchilsea and others, to the Board of Agriculture, from the publications of the Society for Bettering the Condition of the Poor, and from a late interesting work printed by Mr. Arthur Young,* that such a system is productive of the happiest consequences. It is supposed, however, to be totally inapplicable to an arable district. I trust that such an opinion will not be admitted, without full consideration. Indeed, so far as I can judge, this advantageous system, is to the full as well adapted for the one district as for the other. It requires unquestionably more labour on the part of the cottager, and of his family; at the same time, the occupation of so great an extent of ground is not so necessary in arable, as in grazing, countries; a circumstance, in various respects, extremely material.

In arranging the following plan (which the reader will please to consider, merely as furnishing an outline to be perfected by farther discussion and experiment), it is proposed to keep in view the following principles:

1. That the cottager shall raise, by his own labour, some of the most material articles of subsistence for himself and his family.

2. That he shall be enabled to supply the adjoining markets, with the smaller agricultural productions; and

3. That both he and his family shall have it in their power, to assist the neigh-

* Intitled, "an Inquiry into the Propriety of applying Wastes, to the better Maintenance and Support of the Poor."

bouring farmers, at all seasons of the year, almost equally as well, as if they had no land in their occupation.

It can hardly be questioned, that if it were practicable to have a number of cottagers of that description, in every parish, it would promote, in various respects, the interests of the public.

I. *Extent of Land necessary.*

Unless the experiment were fairly tried, it is impossible to state exactly the extent of arable land requisite, to enable a cottager to raise the articles generally necessary for the sustenance of himself and family, and to keep a cow, some pigs, and poultry. Much must depend upon the natural richness of the soil (though under the management about to be proposed, almost any soil would, in time, become fertile); on the nature of the climate; on the size of the cow; on the industry of the cottager; on the age and number of his family, &c. But I should imagine, that three statute acres and a quarter, of good arable land, worth from 20*s.* to 30*s.* per acre, would be sufficient. It is proposed, that the three acres shall be under a regular course of cropping. The quarter of an acre ought, if possible, to be converted into an orchard, where the cow might occasionally pasture, and where a pond ought to be kept in good order, that it may have plenty of water at command. Were the land of a quality fit for lucerne, perhaps two acres and a quarter might be sufficient.

II. *Stock and Instruments of Husbandry.*

It is evident, that so small an extent of land, as either two or three acres, under cultivation, excludes all idea of ploughing,* and indeed, unless the cottager shall manage the whole, in the simplest and cheapest manner, there is an end to the whole system. It would require indeed, four or five acres to keep a single horse, and the expence of purchasing horses, or even oxen, ploughs, and other instruments of husbandry, must be far beyond the abilities of a cottager; whereas with a spade, a hoe, a rake, a scythe, a sickle, and a flail, which are all the instruments really necessary, he is perfectly competent to the management of his little farm.

* Ploughs might, perhaps, be hired; but, on the whole, the spade-culture is infinitely preferable, and I would much rather see a cottager hire persons to trench, than to plough for him.

III. *Course of Crops, &c.*

The three acres proposed to be cultivated, should be divided into four portions, each consisting of three roods, under the following system of management:

	Roods.
Under potatoes, 2 roods, under turnips, 1* - -	3
Under winter tares, 2 roods, spring tares, 1 - -	3
Under barley, wheat, or oats - - - -	3
Under clover, with a mixture of rye grass† - -	3
Total	12 Roods.

Other articles besides these might be mentioned, but it seems to me of peculiar importance, to restrict the attention of the cottager to as few objects of cultivation as possible.

It is proposed, that the produce of the two roods of potatoes, shall go to the maintenance of the cottager and his family;‡ and that the rood of turnips should be given to the cow in winter, and during the spring, in addition to its other fare.

The second portion, sown with tares (the two roods of potatoes of the former year, to be successively sown with winter tares, and the turnip rood with spring tares), might partly be cut green, for feeding the cow in summer and autumn, but if the season will permit, the whole ought to be made into hay for the winter and spring feed, and three roods of clover cut green for summer food.

The third portion, may be sown either with barley, wheat, or oats, according to the soil or climate, and the general custom of the country. The straw of any of these crops, would be of essential service for littering the cow, but would be still more useful, if cut into chaff, for feeding it.

The fourth portion, appropriated to clover and rye-grass, to be cut green, which,

* I would also recommend a small quantity of flax, where the culture and management of the plant was known, to employ the females, particularly in winter, and to supply the family with linen.

† Some recommend the proportion, per acre, to be at the rate of one bushel of rye grass, to 12 lbs. of red clover; others, 14 lbs. of red clover, to half a bushel of rye grass.

‡ By Sir John Methuen Poore's experiments, it was found, that half a rood, or one-eighth of an acre, produced, for several years, as great a weight of potatoes, as was sufficient for a family of four persons.—Four acres answered for 131 persons.

with the assistance of the orchard, will produce, on three roods of land, as much food as will maintain a cow and her calf for five months, namely, from the end of May, or beginning of June, when it may be first cut, to the first of November, besides some food for the pigs. It is supposed, that an acre of clover and rye grass, cut green, will produce 20,000 lbs. weight of food for cattle. Three roods therefore, ought to yield 15,000 lbs. weight. A large cow, requires 110 lbs. weight of green food per day; a middling sized cow, such as a cottager is likely to purchase, not above 90 lbs. consequently, in five months, allowing 1320 lbs. weight for the calf and the pigs, there will remain 13,680 lbs. for the cow.* Were there however, even a small deficiency, it would be more than compensated, by the rood of land, proposed to be kept in perpetual pasture, as an orchard.

IV. *Mode in which the Family may be maintained.*

It is calculated, that three roods and eight perches of potatoes, will maintain a family of six persons, for about nine months in the year, but according to the preceding plan, it is proposed to have but two roods under that article, for however valuable potatoes are justly accounted, yet some change of food would be acceptable, and the cottager will be enabled, from the produce of the cow, and by the income derived from his own labour, and from that of his family, to purchase other wholesome articles of provision.

V. *Manner in which the Stock may be kept.*

It appears from the preceding system of cropping, that ten roods of land, or two acres and a half, are appropriated to the raising of food for the cow in summer and winter, besides the pasture of the orchard; and unless the season should be extremely unfavourable, the produce will be found, not only adequate to that purpose, but also to maintain the calf for some time, till it can be sold to advantage. It is indeed extremely material, under the proposed system, to make as much profit of the calves as possible, as the money thus raised, will be a resource, enabling the cottager to replace his cow, when a new one must be purchased.

For the winter provision of the cow, which is the most material, because summer food can be more easily procured, there is the produce,

* These calculations are merely given as data for experiment. It must depend upon the season, whether the tares or the clover should be made into hay.

1. Of about three rood of tares made into hay.

2. Of three roods of straw, deducting what may be necessary for litter; and if dry earth be put in the cow's hovel, and removed from time to time to the dung-hill, little or no litter will be necessary.

3. Of one rood of turnips.

The whole will be sufficient for seven months in the year, namely, from the 1st November to the 1st June; and during the remaining five months, the pasture of the orchard, some of the winter tares, and the produce of three roods of clover and rye-grass, will not only suffice, but will furnish a surplus for the calf, if it is kept for any length of time,* and some clover for the pigs.

The inferior barley, potatoes, &c. will of course be given to the pigs and the poultry.

VI. *Value of the Produce.*

The land thus managed will certainly produce, by means of the extra industry of the family, and at a small expence, a most important addition to the income which the cottager may derive from his ordinary labour. For instance,

	per Ann.
1. The orchard (after the trees become fruitful), will probably yield	£. 1 10 0
2. Three roods of turnips and potatoes - - -	4 0 0
3. Eighteen bushels of barley, at 4*s.* - - -	3 12 0
4. The cow and calf† - - - - -	7 0 0
5. Hogs - - - - - - -	3 0 0
6. Poultry and eggs - - - - -	2 0 0
Total	£. 21 2 0

* In a pamphlet just published by Richardson, Cornhill, on the culture of potatoes, price 1*s.* the following mode of applying the refuse potatoes, to the feeding of calves, is strongly recommended.

" Take two gallons of small potatoes, wash them clean, put them into a pot of boiling water " sufficient to cover them, and let them boil till the whole becomes a pulp: then add more water, " and run the whole through a hair sieve, which will produce a strong nutritive gruel. At first " use a very small quantity, warmed up with milk, to make it palatable to the calf, and increase " the quantity daily, till it becomes equal. A quart of potatoe gruel, and a quart of scald or " skimmed milk, will be sufficient for a good meal, which should be given warm three times a " day."

† According to Mr. Kent's calculations, a cow should produce six quarts of milk per day, worth

Where wheat can be raised, instead of barley, the profit would be still more considerable. Opinions will differ much, regarding the value put on each article, but that is of little consequence, as the total cannot be accounted too high.

VII. *Time required for cultivating the Land.*

The quantity of land intended to be cultivated, will not materially interfere with the usual labour of the cottager. It will only require to be dug once, and is then fit to be cropped. It is proposed, that only nine roods shall be annually cultivated (the remaining three roods being under clover and rye grass), and nine roods may be dug in the space of about 558 hours, or at the rate of 62 hours per rood. This might be done at bye hours (more especially when the family of the cottager shall be somewhat advanced, and consequently more able to furnish assistance), but supposing that the digging, manuring, harvesting, &c. will require twenty entire days, per annum, in addition to the bye hours, and allowing sixty days for Sundays and holidays, there will remain 285 days, for the ordinary hand labour of the cottager, which, at 1*s.* 6*d.* per day, would amount to £21. 7*s.* 6*d.*; the earnings of the wife and children, may at an average, be worth at least £4. per annum more. This is certainly a low calculation, considering how much may be got during the hay and corn harvests: but even at that moderate estimate, the total income of the family will be as follows:

1. Produce of the farm	£21	2	0
2. Labour of the cottager	21	7	6
3. Earnings of the family	4	0	0
Total	£46	9	6

VIII. *Buildings.*

It is impossible to calculate the expence of building a cottage, as so much depends upon its size, the place where it is situated, the materials of which it is composed, the price of labour in the country, and a variety of other circumstances. On this important subject, much useful information is contained in the first volume of the Communications published by the Board of Agriculture. But it is proper

1*d.* per quart, equal to 3*s.* 6*d.* a week, or £9. 2*s.* per annum, setting the profit of the calf, against the loss sustained when the cow is dry: But it is better to be rather under than over the mark.

to observe, that no expensive additional buildings will be necessary, in consequence of the proposed system. A shed or hovel for the cow, cannot occasion any very heavy charge, and a small barn, of the simplest and cheapest construction, may be of use, not only for threshing the crop, but also for securing the hay, and making it to more advantage, in case the season should prove unfavourable; if the corn is put up in small stacks, the barn may be made of very moderate dimensions.

IX. *Rent and Balance of Income.*

The rents of cottages, and of land, vary so much in different parts of the kingdom, that it is difficult to ascertain an average; but if the cottage shall be stated at £3. per annum, the land at 25*s.* per acre, and the orchard at 10*s.* the whole will not exceed £7. 15*s.* The cottager will also be liable to the payment of some taxes, say to the amount of £1. 5*s.* more. Hence the total deductions would be about £9. leaving a balance in favour of the cottager of £37. 9*s.* 6*d.* Considering the cheap rate at which he is furnished with a quantity of potatoes, equal to several months consumption, and with milk for his children, surely, with that balance, he can find no difficulty, not only in maintaining himself and family, in a style of comfort, but also in placing out his children properly, and laying up a small annual surplus, that will render any parish assistance, whether in sickness, or old age, unnecessary; and thus he will be enabled to preserve that manly and independant spirit, which it so well becomes a British cottager to possess.*

CONCLUSION.

Advantages of the proposed System.

I shall now endeavour briefly to explain some of the advantages which may be looked for with confidence, from the proposed system.

In the first place, the land possessed by the cottager, would be completely cultivated, and rendered as productive as possible. The dung produced by the cow, the pigs, &c. would be amply sufficient for the three roods under turnips and

* The different expence of fuel in the various districts, will, it is evident, greatly affect the annual surplus.

potatoes, which would afterwards produce, 1. Tares, 2. Barley, and 3. Clover, with a mixture of rye-grass, in regular succession, without any additional manure. The barley should yield at least 18 bushels, besides 3 bushels for seed, and if wheat or oats are cultivated, in the same proportion. The milk, deducting what may be necessary for the calf, and for the cottager's family, might be sold in its original state, if there shall be a market for it, or converted into butter, for the purpose of supplying the neighbouring towns or villages. Such cottagers also, might certainly send to market both eggs and poultry.

2. It is hardly possible, to suggest a measure, more likely to promote the benefit, of a numerous and valuable body of people. The system of keeping cows by cottagers, which has been found so advantageous in the grazing districts, may thus be extended over the whole kingdom; and indeed, if the above plan is found to answer, in place of 4 or 5 acres employed in feeding a single cow, it would be much better, even in the grazing counties, to restrict the land to a smaller quantity, under a tillage mode of management; for thus not only the cow, but also the cottager himself and his family, would, in a great measure, be maintained by a less surface of soil.

3. It is of infinite consequence, to establish the practicability of this system, as the means of removing a most unfortunate obstacle to the improvement of the country. It is well known, to be the only popular objection to the Inclosure of our Wastes and Commons, that, while uninclosed, a number of cottagers are enabled to keep cows, by the means of their common-rights, and that their cows disappear when the commons are inclosed. But if so small a portion of land as $3\frac{1}{4}$ acres, when improved and properly cultivated, can enable a cottager to keep a cow, even to more advantage, than with a right of common, which can hardly be doubted, as he is enabled to provide winter as well as summer food, there is an end to that obstacle to improvement. Indeed, if sufficient attention be paid to the principles above detailed, the situation of the cottager, instead of being deteriorated, would be materially bettered by the inclosure; and his rising family, would be early accustomed to habits of industry, instead of idleness and vice.

I shall conclude with asking, if any one can figure to himself, a more delightful spectacle, than to see an industrious cottager, his busy wife, and healthy family, living in a comfortable house, rented by himself, cultivating their little territory with their own hands, and enjoying the profits arising from their own labour and industry?

or whether it is possible for a generous landholder, to employ his property with more satisfaction, or in a manner more likely to promote, not only his own, but the public interest, than by endeavouring to increase the number of such cottagers, and encouraging, by every means in his power, the exertions of so meritorious, and so important a class of the community?

JOHN SINCLAIR.

London, May 1801.

Plan of the proposed Cottage Farm, pointing out the Rotation of Crops in the different Lots.

Cottage.	The Orchard, or perpetual Pasture.	Pond.

Lot A.	Lot B.
3 Roods.	3 Roods.
1 Year { 2 Roods Potatoes, 1 Rood Turnips	1 Year { 2 Roods Winter Tares, 1 Rood Spring Tares

Lot C.	Lot D.
3 Roods.	3 Roods.
1 Year Barley, Wheat, or Oats.	1 Year Clover, and Rye grass.

The Rotation of Crops for Four Years.

Year.	Lot A.	Lot B.	Lot C.	Lot D.
1	Potatoes and Turnips	Winter and Spring Tares	Barley, Wheat, or Oats	Clover and Rye grass
2	Winter and Spring Tares	Barley, Wheat, or Oats	Clover and Rye grass	Potatoes and Turnips
3	Barley, Wheat, or Oats	Clover and Rye grass	Potatoes and Turnips	Winter and Spring Tares
4	Clover and Rye grass	Potatoes and Turnips	Winter and Spring Tares	Barley, Wheat, or Oats

The rotation then begins as at first. Lot D, might continue in natural grass the first season, to diminish the labour of that year.

The exact period when the different crops should be dug for, or sown, cannot be ascertained, because it varies so much in different counties, and depends upon the seasons; but according to the above rotation, the labour of digging for the various crops is diversified as much as possible, so as not to interfere materially with the other occupations of the cottager. At no period, would it be necessary for him to dig more than two roods in a month; and both he and his family, will labour with much more satisfaction and dispatch, when they work for themselves, than for another. In case of necessity, the cottager might hire some of his neighbours to assist him in digging, which would be much better than hiring a plough. If a cottager under this system, could not work as a common daily labourer, he might at least answer, as a useful labourer by the piece.

Case of a Cottager. *By Sir* Henry Vavasour, *Bart.*

To the Right Hon. LORD CARRINGTON, *P. B. A. &c.*

MY LORD London, May 20th, 1801.

I HAVE had the honour of mentioning, in conversation to your Lordship, the advantages that appeared to me, in cultivating land in the Flemish manner, or, what is now called, about Fulham and that neighbourhood, the *Field-gardening* husbandry. I have for some years encouraged my cottagers in Yorkshire, in this mode of managing their small garths or gardens, which are in general, from one to three acres, and I have now an opportunity of stating the husbandry of a poor industrious cottager's garth. As the man can neither read or write, these particulars have been

transmitted to me, from his own mouth, and as I saw his land almost every day during the last harvest, I can vouch that this account is not far from the truth.

Produce.	Value.	A.	R.	P.
240 Bushels of potatoes	£. 24 0 0	0	2	0
60 Ditto of carrots - - -	6 0 0	0	1	0
5 Quarter of oats, at 44*s.* per quarter -	11 0 0	0	3	20
4 Loads of clover, part in hay, part cut green	12 0 0	1	0	0
Turnips - - - -	1 0 0	0	0	20
In garden-stuff for the family, *viz.* beans, pease, cabbages, leeks, &c. -	0 0 0	0	0	30
	£. 54 0 0*	3	0	0

Deduct Rent -	£. 9 0 0	Including the House.
Seeds, &c. -	3 0 0	
Value of labour	10 10 0	
	£. 22 10 0	Produce before stated
	£. 54 0 0	
	22 10 0	
Profit	£. 31 10 0	if sold at market exclusive of butter.

His stock was two cows and two pigs ; one of his cows had a summer's gait for twenty weeks with his landlord.—The land was partly ploughed and partly dug with the spade, cultivated (the ploughing excepted) by the man, his wife, and girl about twelve years of age, in their *spare* hours from their daily *hired* work, seldom a whole day off, except in harvest—made the rent in butter, besides a little used in the family.—The man relates that he thinks he clears, one year with another, from the three acres, about £.30. The daily wages his family earns about keep them.—It is very evident that this man clears from his three acres more than a farmer can possibly lay by from more than eighty acres of land, in the common husbandry of the country, paying for horses, servants, &c. and it must be obvious to every one how great the advantages must be to society, by cultivating land in this manner. It

* These sums are conformable to the prices of this year, but it is evident, that in other seasons, they must in general be lower.

would have taken more than half the quantity of his three acres in pasture, for one cow at grass during half the year; whereas (excepting the summer's gait for one of his cows, as mentioned before) his stock of two cows and two pigs is kept and carried on the whole year. The family lives well, and a handsome sum has been yearly saved to place out two sons, and supply them with clothes, washing &c.

I am, &c.

HENRY VAVASOUR.

P. S. The man's name is *Thomas Rook*.

No. XX.

An experimental Essay on Salt as a Manure, and as a Condiment mixed with the Food of Animals. *By the Rev.* Edmund Cartwright, *of Woburn.*

SAL SAPIT OMNIA.

Sent in claim of the Premium offered by the Board, and to which Essay the Gold Medal was adjudged.

WERE the beneficial effects of salt as a manure to be once fairly ascertained, there can be no doubt but the wisdom of the legislature would devise some means by which, without prejudice to the revenue, the farmer might apply it to the purposes of agriculture.

At present the use of salt as a manure is a subject on which the public opinion is much divided; its advocates, reasoning from the striking effects of salt water on the marshes which are occasionally irrigated by the sea at spring tides, conclude that the fertilizing virtue of such irrigation is owing to its saline quality, without taking into consideration the quantity of animal and vegetable matter which sea water (particularly near the coast, and where rivers disembogue themselves) must necessarily hold in solution.

Those who maintain a contrary opinion, considering salt merely as an antiseptic, satisfy themselves that it is impossible that any thing can be friendly to vegetation, which retards putrefaction, a process indispensible in substances that are to be the food of plants. To get over this difficulty, it has been conjectured, nay, there have not been wanting those (and of great name too) who have even attempted to prove, that salt in small quantities accelerates, as in large quantities it is known to resist, putrefaction; a doctrine to which, however, I shall not willingly yield my assent,

till I can be persuaded that effects are not, in all cases, proportionate to their causes. The operation of every cause is, and must be, uniform; and when, to appearance, it is not so, some other cause obtrudes itself, too subtile for our observation, which operating at the same time with the primary cause, joins in giving a result, which not being able to account for, we consider as anomalous.

That theorists should be at variance with each other is not to be wondered at, for having the wide field of imagination and conjecture before them to expatiate in, it is reasonable to conclude, indeed it is unavoidable, that some of them must lose their way. But what shall we say to the disagreement and inconsistency which prevail on this subject amongst practical farmers? Nothing, indeed, can be more contradictory than the different reports that have been made on the effects of salt, as a manure, by those who have even brought it to the test of actual experiment. As there is no reason to question the veracity of the reporters, we must look for the grounds of their disagreement in some predominating circumstance or other, which at the time escaped their observation. Indeed, the success or failure of an agricultural experiment depends so frequently on causes which can neither be controlled nor foreseen, and so foreign from those which were expected to operate, that it is not to be wondered at if the repetition of the very same experiment gives oftentimes a different result.

As it is not the business of this paper to support a theory, but to detail what has been practised; not to contend for an opinion, but to state facts; the few observations which may be hazarded will be such only as are required merely in explanation of occurrences as they arise. I shall endeavour to give, therefore, as simple a relation as possible of the experiments I have tried, to ascertain the advantages or disadvantages which may attend the use of salt as a manure, and also when mixed with the food of animals.

It may be necessary first of all to premise, that the soil on which my experiments were tried, is a ferruginous sand, brought to a due texture and consistence by a liberal covering of pond-mud. Of this soil, in its improved state I mean, by the accession of pond-mud (for having been used merely as a nursery for raising forest trees previous to these experiments, the nursery-man had not thought it necessary to make use of any other manure), the following is the analysis.

	Grains.
400 grains gave of siliceous sand of different degrees of fineness about -	280
Of finely divided matter, which appeared in the form of clay - -	104
Loss in water - - - - - - -	16
	400
The 104 grains of finely divided matter contained of carbonate of lime -	18
Of oxide of iron - - - - - - -	7
Loss by incineration (most probably from vegetable decomposing matter) -	17

The remainder principally silex and alumine.

There were no indications of either gypsum or phosphate of lime.

It will appear from the above analysis that these experiments could not, perhaps, have been tried on a soil better adapted to give impartial results; for of its component parts there is no ingredient (the oxide of iron possibly excepted) of sufficient activity to augment or restrain the peculiar energies of the substances employed.

On the 14th of April, 1804, a certain portion of this soil was laid out in beds one yard wide, and forty long. Of these, twenty-five were manured (the first excepted) as follows:

No. 1. No manure.
2. Salt, $\frac{1}{4}$ peck.
3. Lime, one bushel.
4. Soot, one peck.
5. Wood-ashes, two pecks.
6. Saw-dust, three bushels.
7. Malt-dust, two pecks.
8. Peat three bushels.
9. Decayed leaves, three bushels.
10. Fresh dung, three bushels.
11. Chandler's graves, nine pounds.
12. Salt, lime.
13. Salt, lime, sulphuric acid.
14. Salt, lime, peat.
15. Salt, lime, dung.
16. Salt, lime, gypsum, peat.
17. Salt, soot.

} N. B. The quantities of each ingredient the same as when used singly.

No. 18. Salt, wood ashes.
19 Salt, saw-dust.
20. Salt, malt-dust.
21. Salt, peat.
22. Salt, peat, bone-dust.
23. Salt, decayed leaves.
24. Salt, peat-ashes.
25. Salt, chandler's graves.

N. B. The quantities of each ingredient the same as when used singly.

On the same day the whole was planted with potatoes, a single row in each bed; and, that the general experiment might be conducted with all possible accuracy, each bed received the same number of sets.

On the 14th of May (a few days after the plants appeared above ground) the whole was carefully examined, and the comparative excellence of each row (as far at least as could be judged of by appearances) was as carefully registered. The best row was decidedly No. 7, malt-dust, after which they followed as under:

No. 11. Chandler's graves.
16. Salt, lime, gypsum, peat.
25. Salt, graves.
20. Salt, malt-dust.
9. Decayed leaves.
4. Soot.
2. Salt.
1. No manure.
5. Wood-ashes.
8. Peat.
13. Salt, lime, sulphuric acid.
14. Salt, lime, peat.
17. Salt, soot.
18. Salt, wood-ashes.
21. Salt, peat.
22. Salt, peat, bone-dust.
23. Salt, decayed leaves.
3. Lime.
6. Saw-dust.

No. 10. Fresh dung.
12. Salt, lime.
15. Salt, lime, dung.
24. Salt, peat-ashes.
19. Salt, saw-dust.

On the 28th of May, fourteen days afterwards, the apparent vigour of the plants was the following order:

No. 7. Malt-dust.
11. Chandler's graves.
4. Soot.
8. Peat.
16. Salt, lime, gypsum, peat.
17. Salt, soot.
20. Salt, malt-dust.
21. Salt, peat.
23. Salt, decayed leaves.
25. Salt graves.
1. No manure.
2. Salt.
5. Wood-ashes.
9. Decayed leaves.
13. Salt, lime, sulphuric acid.
14. Salt, lime, peat.
18. Salt, wood-ashes.
24. Salt, peat-ashes.
10. Fresh dung.
3. Lime.
22. Salt, peat, bone-dust.
19. Salt, saw-dust.
15. Salt, lime dung.
12. Salt, lime.
6. Saw-dust.

On the 21st of September, the potatoes were taken up, when the produce of each row was in succession as follows:

No. 17.	Salt and soot produced	240
11.	Chandler's graves	220
18.	Salt, wood-ashes	217
16.	Salt, gypsum, peat, lime	201
15.	Salt, lime, dung	199
2.	Salt	198
25.	Salt, graves	195
4.	Soot.	192
10.	Fresh dung	192
20.	Salt, malt-dust	189
5.	Wood-ashes	187
23.	Salt, decayed leaves	187
24.	Salt, peat-ashes	185
7.	Malt-dust	184
14.	Salt, lime, peat	183
19.	Salt, saw-dust	180
22.	Salt, peat, bone-dust	178
9.	Decayed leaves	175
13.	Salt, lime, sulphuric acid	175
21.	Salt, peat	171
12.	Salt, lime	167
8.	Peat	159
1.	No manure	157
6.	Saw-dust	155
3.	Lime	150

The foregoing table furnishes many particulars worthy of observation. In the first place it is remarkable, that of ten different manures, most of which are of known and acknowledged efficacy, salt, a manure hitherto of an ambiguous character, is superior to them all, one only excepted! And again, when used in combination with other substances, it is only unsuccessfully applied in union with that one, namely, chandler's graves, no other manure seemingly being injured by it. Possibly its deteriorating effects on chandler's graves may be owing to its antiseptic property,

which retards the putrifacture process by which animal substances undergo the changes necessary to qualify them to become the food of plants. This, however, I cannot, from any appearance in the soil when the plants were taken up, assert to have been the case.

The extraordinary effects of salt, when combined with soot, are strikingly singular. There is no reason to suppose these effects were produced by any known chemical agency of soot or salt on each other. Were I to guess at the producing cause, I should conjecture it to be that property of saline substances by which they attract moisture from the atmosphere; for I observed those beds, where salt had been used, were visibly and palpably moister than the rest, even for weeks after the salt had been applied, and this appearance continued till rain fell, when, of course, the distinction ceased. This property of attracting moisture had greater influence, possibly, on the soot than on any of the other manures, as soot, from its acrid and dry nature, may be supposed to require a greater proportion of water to dilute it, than those substances which contain water already. It may be proper to observe, that on those beds where salt had been used, the plants were obviously of a paler green than on the rest, though not less luxuriant: a circumstance which I thought worth noticing, and which I considered, though erroneously (as appeared by the event) to indicate a want of vigour, which would be felt in the crop. It was observable also that where salt was applied, whether by itself, or in combination, the roots were free from that scabbiness which oftentimes infects potatoes, and from which none of the other beds (and there were in the field nearly forty more than what made part of these experiments) were altogether exempt.

Two sets of experiments, and with the same proportions of manures, were tried with turnips and buck-wheat, on a soil the poorest I could meet with, which produced only a dwarf heath and lichen, and which I had had pared off. The poverty of this soil will appear by the following analysis:

400 grains gave of siliceous sand - - - -	320
Of finely divided matter, which appeared as brown mould - -	68
Loss in water - - - - - - -	12
	400

The finely divided matter lost by incineration nearly half its weight, which shews it contained a great deal of vegetable matter. The residuum, principally a mixture of

aluminous and siliceous earths, coloured red by oxide of iron, and containing very little calcareous matter. There were no indications of either gypsum or phosphate of lime.

July 6th, 1804, the pieces set apart for each set of experiments were respectively sown with turnips and buck-wheat.

On the 26th, No. 1, 2, 4, 5, 6, 7, 19, 20, 21, 22, 24, 25, shewed little or no marks of vegetation. The remainder were merely in the seed leaf.

On the 16th of August, 4 only were alive and in rough leaf, namely,

No. 12. Salt and lime.
13. Salt, lime, and sulphuric acid.
14. Salt, lime, peat.
16. Salt, lime, gypsum, peat.

These four maintained a sickly existence till the middle of September, shortly after which they all disappeared. (N. B. The appearances of the turnips and buck-wheat were so nearly uniform, I have not thought it necessary to notice the trifling variations between them, which could not have been done without entering into a minute detail, equally tedious and uninteresting.)

Though nothing decisive can probably be drawn from these two sets of experiments respecting the advantages or disadvantages of salt as a manure, on such a soil as I have described, because other manures of acknowledged efficacy shared the same fate with the salt, yet this inference, however, may be drawn from them (and that not an unimportant one) namely, that a due texture and consistence in the soil is as necessary to the existence and health of vegetables, as the pabulum they are sustained by; and this appears evidently by the superiority (such as it was) of those plants where the manure contributed in any degree to improve that texture and consistence.

Adjoining to the place where these experiments were tried is a field, which fully confirms this observation. Within these few years, a great part of it was in a state of uncultivated nature, equally barren as the spot I have been speaking of; it is, however, now brought into cultivation, and into a decent state of fertility, chiefly from its texture having been improved by a thick coating of marly clay.

In trying the effects of salt, when mixed with the food of animals, I have made no experiments on sheep, as I did not apprehend that a few limited experiments would either throw new light upon a subject which has already been sufficiently discussed, as applied to those animals, or furnish the public with facts of which it

is not already in possession. My experiments have, therefore, been confined to hogs and cows.

On July 23d, 1804, three hogs of the same litter about eight months old were put up to fatten. Their respective weights were as follows:

No. 1. 44 lbs.
2. 47 lbs.
3. 40 lbs.

From the 23d of July till the 7th of August, they were fed with barley-meal mixed up with water, during which time they consumed three bushels and a half of barley, and gained in weight as follows:

No. 1. 12 lbs.
2. 10 lbs.
3. 5 lbs.

From the 3d of August to the 21st, they had salt mixed with their food, of which they consumed one quarter of a pound per day. The food consumed was four bushels; they had gained upon the last weighing, as under:

No. 1. 18 lbs.
2. 22 lbs.
3. 14 lbs.

From the 21st of August to the 3d of September, the salt was discontinued, in which time they eat four bushels and a half of barley-meal, and their increase of weight was:

No. 1. 24 lbs.
2. 21 lbs.
3. 21 lbs.

From the 3d of September to the 17th, they had salt as before, and their consumption of food was the same as during the last fortnight, namely, four bushels and a half of barley-meal. Their gain of weight was,

No. 1. 31 lbs.
2. 19 lbs.
3. 19 lbs. They were then slaughtered.

It did not appear that the salt had any operation either in promoting thirst, or stimulating their appetites, the consumption of food being nearly the same whether salted or not, neither does it appear that the salt had any influence on their

fattening; perhaps the quantity allowed them was too little; and yet I should think not, as there was enough to make their whole mass of food sufficiently savory to the human taste.

In trying this experiment it will be observed, that I did not confine one parcel of hogs to salt, and another to unsalted food. This mode of trying experiments is always uncertain, as there will be frequently particular habits and tendencies in the individual animals which will vary the results, and prevent their being uniform. The fairest way, and that which is the least liable to error, is to compare each animal with himself, by feeding him at one period with one kind of food, and then, for an equal period, with another. If this principle which I have proceeded upon be right, there is nothing in these experiments to encourage the practice of administering salt to hogs with a view, at least, to increase their tendency to fatten; how far it may contribute to keep them in health is a different question, and on which years of experience may probably be necessary to decide. Now I am upon this subject, I shall mention (though totally foreign to the object of this essay), that most internal disorders which hogs are liable to, all of which may be supposed to be more or less accompanied with fever, I find no remedy so efficacious as antimony. This mineral is said to have obtained its name from the head of a religious house, who had administered it with success to his hogs, giving it in such quantities to the monks of his order, as to poison them. A circumstance which, probably, brought it at the time into disrepute as a medicine, as well for the real, as the metaphorical hogs. The anecdote, however, whether true or false, induced me some years ago to try it upon hogs; and I can safely aver that, when taken in time, there are few internal diseases which hogs are subject to, that will not yield to antimony in some form or other. That form which I prefer is emetic tartar, as lying in small compass. I give it in doses from five to forty or fifty grains, according to the age and strength of my patient, and I believe still larger doses might be given with equal safety, as I do not recollect a single instance in which the animal seemed to suffer from being over-dosed.

To persons who have not tried the effects of antimony on the brute creation, the quantity I give may seem to be strangely disproportionate to the bulk of the hog, compared with that of a man; but the experience of many years has convinced me that there is no analogy (I mean as far as *quantity* is concerned) in the effects of antimony on the human constitution, and on the constitution of inferior animals.

On the 9th of October, 1804, my experiments on cows commenced. On that day two Welch heifers, one of which had calved about five months, the other three, were confined to the house, and fed with hay for the space of one fortnight. The hay they consumed during that time was four hundred weight nineteen pounds, and the milk they produced was thirty-six gallons three quarts. They had then for the next fortnight, salt mixed with their hay, the hay being first slightly moistened with water and the salt sprinkled over it; in which time they consumed four hundred weight forty-two pounds of hay, and seven pounds of salt. The milk produced was thirty-seven gallons. For the next fortnight, namely, from the sixth to the twentieth of November, the salt was omitted, and their food was four hundred weight and one quarter of hay, and two hundred weight and a half of cabbages. The produce of milk in that space of time was fifty-four gallons three quarts. From the twentieth of November, their food was the same as before, with the addition of half a pound of salt per day. The produce of milk was fifty-seven gallons one quart.

It will be recollected that salt seemed to have no tendency to promote thirst, or to increase appetite in the hogs; yet on the cows its effects in one respect was very perceptible, for during the period they had salt they drank three gallons a day each more than at other times.

Salt may possibly promote digestion (notwithstanding its antiseptic quality) by stimulating the salival glands, and the glands yielding the gastric juice, and by inducing an increased discharge of their respective fluids, so necessary to the solubility of the different substances received into the stomach before they can be admitted into the lacteals.

Though there may be nothing in the foregoing experiments to lead us to suppose that salt has any otherwise a tendency to promote a disposition in animals to fatten than as it may contribute to their health, by aiding their digestion; yet it is probable that, when administered to animals yielding milk, it may contribute in some small degree to increase that secretion; and this it may do by promoting thirst, which induces the animal to drink copiously, in consequence of which the secretion of milk, as well as all other secretions of the fluids, may be augmented. Perhaps also, it may have a stimulating influence on the lacteals themselves.

And yet after all, admitting these experiments to prove that salt increases in some small degree the production of milk, when that increased quantity is balanced against the price of the salt, the dairy-man will find himself no gainer.

Though there does not seem any thing in these experiments, either with hogs or cows, to encourage the practice of giving salt to animals with a view to increase their disposition to fatten, yet it would be temerity to affirm that it is entirely useless. From the avidity with which most, if not all kinds of graminivorous animals, whether in a state of domestication or otherwise, are known to eat salt, whenever it comes in their way, it is reasonable to conclude that the propensity has not been implanted in them in vain. But from whatever cause its salutary effects may be supposed to proceed, whether (as was hinted at before) from its promoting digestion, and an increased secretion of fluids, or from any other action it may have on the animal œconomy, it must be left to an experimenter, more successful than I have been, to ascertain.

No. XXI.

On rearing Calves.

MY LORD,

THE following is the method I have pursued with great success in weaning my calves.

The calf should be taken away when about a week old, (or when the cow's udders are perfectly cleansed from all hardness), and kept at a distance, out of the hearing of their mothers. For the first few days (according to the strength of the calf) my servant gives them *new milk*, and by dipping their mouths in the milk, it will soon entice them to drink; but gradually lowering the *new milk* to that which has been skimmed. The skimmed milk should have a piece of red hot iron plunged into it, not only to warm it, but to give it an astringent quality: but should the calf scour on the change of milk, I have always found a table spoonful of Bigg's Calves Cordial, given daily for a short time, always remove it. At about three weeks old the calves will begin to lick up bran, bruised oats, &c. and pick a little hay. When that is the case, powder some oil cake very fine, and mix it with the bran, &c. in the manger: in a very short time they will eat it greedily in small pieces; *the taste they never forget*, so that there is not any trouble in fatting them when grown up.

I generally, as my calves come soon after Christmas, keep them tied up till April; but when they fall later in the spring, they may be let out in the middle of the day for a little grass, still giving the oil cake and bran, but lowering the milk with water till the milk is quite taken off. When a calf falls at Christmas, about February I give him some cut potatoes, but carrots or parsnips are better. About Midsummer they lose a little blood; or if any calf should at any time not keep what his companions, he should be bled, as the oil cake thickens their blood more than common food. By the above method you get your full dairy in the winter, and

your calves do not fall off as when they are taken from the cows at twelve or fifteen weeks old, but continue the whole summer full and straight in the carcase.

I would much recommend about four table spoonsful of Bigg's Cordial, to be given to the cows about an hour after calving, in a quart of warm ale, particularly if the weather is wet and cold.

I am, my Lord,

your much obliged,

&c. &c. &c.

To the Right Hon.
the Lord Sheffield.

No. XXII.

Observations on Manures. *By* Allan M'Conochie, *Esq. now Lord* Meadowbank.

Dear Sir,

I have looked over, with much pleasure, Mr. Somerville's outlines of the 15th Chapter of the intended Report of the Board of Agriculture. At the same time there are some advices in it which appear to me ill-founded; and from considering the great weight that Report must have with the public, I have not only put on the margin a few notes, but am induced, with the liberty of an old acquaintance, to trouble you with two or three remarks at more length on some doctrines in it, which if I may judge from my own experience, now not a short one, stand much in need of correction.

A complete fermentation of dung is recommended; and with that view, the structure of dunghills is prescribed; and as a corollary, the putting it in the land before winter, or when the plants to be nourished are not in a growing state, is dissuaded, from the supposed waste it must suffer in the ground, before the plants can get the benefit of it.

I have ever found that instead of dung being the richest manure when completely fermented, it should if possible be laid on when very imperfectly fermented, but nevertheless when the process is going on at such a rate, as that it must continue after mixture with the soil till it is completed. Every gardener knows that the dung used in hot beds has little effect in comparison of fresh dung; and every farmer knows that a dunghill, which has by any accident been kept for years, is of little more value than so much very rich earth. Every person of attention too, must have remarked the great effects which ensue from turning over a dunghill recently before using it, and that composts operate most powerfully, if used when sensibly hot from the activity of the fermentation which the recent mixture of the ingredients has occasioned, and when consequently that process is very far from being completed. Besides it is very properly observed in the outlines, that much manure is lost from the valuable effluvia that escapes when the upper surface and sides of dunghills are

exposed to the sun, rain, and air. It is well known that these agents powerfully promote fermentation; and surely it deserves consideration, how far the volatile matter extricated in the course of the process of fermentation, is not itself a valuable manure, with which it may be of the greatest importance to impregnate the soil. And there is no sort of doubt that the loss of weight, which dung suffers in a fermenting dunghill, though supplied with moisture sufficient to compensate the evaporation of aqueous particles, is extremely considerable.

According, however, to the practice recommended in the outlines, dunghills are to be constructed in a way to favour a complete fermentation, and only the fermented residuum is to be applied to the soil; a residuum which is supposed to be full of a nutriment for vegetables, soluble in water, and easily wasted away by rains; and being thus subject to waste in the soil, it is allowed to remain in the dunghills, till the season when vegetables have most occasion for it.

Now, Sir, if you consider that a farm dunghill is formed by degrees, and that in good husbandry it is to serve not only one crop, but a succession of crops, till the husbandman has manured the whole circle of his farm, you will perceive that the advice neither suits the origin of the manure, nor the purpose of it. The outlines have not gone so far as to lay it down that the longer a dunghill is kept, it is the better manure; or that it remains in a state of perfection after the fermentation is carried on for a given time: yet unless this proposition is asserted, the first made dung must, according to the directions given, be in a very different state from the last made, when the dunghill is used; and it must on the whole be an unpromising manure, which, though it ought to operate for a series of crops, is to be soluble in water, and to suffer much loss if laid on the soil a few months before the growing season.

It appears to me that both reason and experience dictate the retaining of the first made dung in a state of fermentation, so slow or imperfect that it may suffer little till after being turned over with the later made dung, it forms one powerfully fermenting mass; and that then it should be put into the soil, when the process is so far advanced that it will be completed, when at the same time little loss of substance has yet been suffered, and when what volatile matter is afterwards extricated will diffuse itself through the soil. In these circumstances every thing is lodged in the soil that the dung can yield, either in point of mass or activity; and at the same time it is in a state, when most likely to act as a powerful ferment, for promoting

the putrefaction of the decayed vegetables lying inert in the soil. I certainly, therefore, approve of the preservation of dunghills from much sun and much wind, as well as from that redundancy of moisture, which is apt to overflow and wash away the manure: but I think the pressure which the feet of animals give them, especially of the lighter sort, does good, and prevents that violent fermentation which wastes the substance, and I think exhausts the fertilizing powers of dung. This pressure contributes to preserve it fresh till the time of employing it as a manure calls for putting it all together, and at once, into that highly active state of putrefaction, which, though no doubt checked by its distribution in the soil, is sufficient to insure a gradual and complete dissolution and diffusion of its substance. This may be heightened at pleasure by mixing with the dunghill, when turned over, ashes, lime rubbish, fowl-dung, or other materials, according as the farmer judges it expedient to hasten the putrefaction of the dung when lodged in the soil, or to enable the soil to dissolve quickly inert vegetable matter contained in it; and according to my observation, if such matter abounds in it, the soil, when manure of this sort is added to it, seems to undergo a degree of fermentation which puts it even in a more favourable situation for an effective crop after it is far advanced, than when actually going on. Unless therefore dung is to be used for composts, it appears to me clearly advantageous to get the dung into the soil as early as possible. It is always wasting somewhat when kept out of it; but when put into the soil in a proper state, there is the utmost reason to think that what is extricated goes all to fertilize. Give me leave to add, that I do not believe much is lost by dissolution in rain water. I could never discover any thing of the kind in the water of the furrows of a field properly manured and ploughed. The case every person knows, is quite different in fields recently limed or dressed with ashes; but I am apt to think that the volatile and soluble parts of common dunghills have some attraction with the substance of soils, that prevents their escape. We know that common loam extracts the noisome smell of the woollen cloths used for intercepting the coarser oils that accompany spirits distilled from the sugar-cane, which scarce any detergent besides can obtain from it: and garden loam, impregnated as it must be with fermented dung, is certainly not easily deprived of its fertility by the washing of rain. I must also observe, that I take one of the great advantages derived from using dung with composts, to be the arresting and preserving the fertilizing matter which escapes in the putrefactive fermentation; and another to be, that dung there operates as a

ferment, to putrefy substances not sufficiently disposed to putrefy with activity of themselves. You will observe, that this coincides exactly with the effects I have attributed to it upon soil, and affords a very useful corollary with respect to the substances to be used in top-dressings, which are not to be covered with soil, viz. that if fermenting or putrefying substances are used, the process should have been completed, or nearly so, in a combination that has received the full benefit of it: that it is a great waste to spread common dung on grass, without having first mixed it with mud, loam, or other matter in which it has been dissolved and fixed; so that when spread on the ground, the loss, which would otherwise arise from fermentation and evaporation, is avoided. And, as is observed in the outlines, that if such a compost is used at the time when the plants are in a growing state, and in a way to cover it soon, it is by far the most advantageous method of laying it on.

Another point much insisted on, and certainly of great importance is, that ground is to be limed but once; that light soils and poor clays suffer from a large quantity, which would benefit rich clay or strong loam; that periodical and moderate liming, except in composts, is absurd, &c. &c. I conceive, that sufficient attention is not paid in the outlines to the material fact, that lime, in its caustic state, is pernicious to living vegetables, that when restored to its natural state of limestone, it is not pernicious to any; that when caustic, it is soluble in water; but not so when in its natural state; and that if after being burnt, it is reduced to powder by water, is exposed to the air, and is mixed with the soil, it hastens quickly to its natural state; but that it arrives at this state more quickly in rich or loamy soils, than in poor soils: besides, in its caustic state, the direct effect of lime is to dry, dissolve, and corrode, but not to putrify; whereas in its natural state, it powerfully promotes putrefaction.

I have used lime of a rich quality, viz. eighth-tenths of it calcareous earth, and the remaining two-tenths a blue clay, to a considerable extent as a manure; and after it was restored to its natural state, found that the more of it I gave to even the poorest and thinnest clays, or to the poorest gravel, the soil was so much the more improved; but that on the other hand, even a very small quantity of quick lime, if harrowed in with the seed without dung, was in such soils pernicious to the crop. I believe no farmer will say that he ever saw his crop suffer from the rubbish of an old wall, which is lime restored to its natural state (containing three-fifths gas of its weight by Mr. Higgins's experiments) nor from lime where dung was added, or where the lime shells had been saturated with dung water, however poor the soil on which it

was laid, or large the quantity employed. In the outlines also it seems to be allowed, that chalk and marle, which differ only in point of compactness from lime in its natural state, do not hurt weak soils, though used in great quantities. I conceive, therefore, that it may be laid down as a general rule, that any addition of lime to soils, whether rich or poor, cannot be permanently pernicious, and if restored to its natural state must be more or less advantageous. The best natural soils we know contain a very large proportion of calcareous earth. Those formed of rotted whinstone, contain perhaps nearly one-ninth of calcareous earth; and still they are greatly benefited by farther additions. Delta ground, which is formed of the washings of soils of all descriptions, and the fertility of which is so inexhaustible, must contain a great proportion of calcareous earth; which is generally to be found somewhere in any large extent of country, and we know must abound in water, where it is required so copiously, in the production of the shells and bones of fishes. Lime, however, is still a manure to Delta ground; and I acknowledge, that so far from dissuading additional dressings of lime to land formerly well limed, I am convinced by experience of their utility; and am persuaded that such additions give a new activity to the soil, and ferment the fermentable matter in it, which the calcareous earth already incorporated with the soil, and entangled by various affinities, might otherwise suffer to remain sluggish and useless.

Farther, the frequent recommendation of putting hot shells into composts, seems not a little questionable. This is certain, that one effect of such an operation, is to destroy part of the ingredients that are otherwise useful; for the quick lime instantly saturates itself, not only with the watery matter in the composition, but with the gas to be found in putrefying and inflammable substances. Hence it sensibly burns and wastes dung; and the throwing it into the receptacles of the richest species of manure, which is a practice recommended in the outlines, I will venture to pronounce highly destructive.

I am far, however, from deciding that quick lime, in its state even of greatest causticity, may not be of use in certain composts. Perhaps, for example, in mixture with peat moss, its powerful absorbent and caustic effects may be of use. The very burning part of the moss into a sort of ashes, may afford material aid to the putrefactive powers of the lime, when restored to its effete state; and there is no doubt that the solubility of quick lime in water, by which it is so diffusible through composts as well as soils, may in many cases render lime quenched with pure water,

preferable to lime fully saturated and become effete by exposure to the air, or smoke, or by mixture with dung water. This too is no doubt one of the great advantages derived from the use of quick lime by means of spreading and harrowing it in, and in this way exposing it to a plentiful rain before it becomes effete and insoluble in water: for thereby every particle of the cultivated soil comes to be impregnated with a portion of lime dissolved in lime water; but still where lime is to be used, merely in order to heighten putrefaction in substances (such as dung or decaying vegetables) not averse to putrefaction from any quality which causticity would tend to destroy, I should certainly be inclined to prefer lime rubbish, or lime rendered effete by any means which does not consume manure in the process.

Yours, &c.

ALLAN MACONOCHIE.

Meadowbank, Oct. 23, 1795.

No. XXIII.

On the Culture of Beans. *By* J. C. Curwen, *Esq. M. P.*

My Lord, Ibbotson's Hotel, March, 4, 1805.

I have great satisfaction in complying with your Lordship's request, in transmitting a detail of experiments made in 1803 and 1804, of cutting beans whilst in a perfect fresh and green state.

In 1803 I had drilled four acres of beans, as a shelter for lucerne. The plants in August, proved so luxuriant, as to threaten injury to the lucerne. I therefore ordered them to be cut and removed, and bound up for the chance of being used as fodder. In three weeks, or rather more, they were sufficiently dried for stacking: on examination I found them (contrary to all expectation) very well filled, and perfectly good. This led to their being threshed, and encouraged me to hope that this might turn out an useful discovery.

Happening to have forty acres of strong stiff clay, intended for fallow, I determined to repeat the experiment on a larger scale, and in the month of February 1804, I drilled it with tick-beans, the produce of my former crop, in rows twenty-six inches apart. From May to the middle of July, the ploughs and harrows were constantly at work in it; by the 10th of August, the bean had shot the black eye, which is the criterion of seeds being perfectly formed. Had the weather been favourable, I should immediately have begun cutting them, but was prevented till the 20th. The beans were then cut, spread thinly, and exposed two days to the sun previous to binding and removing to an open pasture, where they remained three weeks; and were then found perfectly dry and fit for stacking.

As a strong proof of the benefit resulting from these early cuttings, I was enabled, previous to drilling with wheat, to give the ground two ploughings, harrowings, &c. and in some parts, three; (the extreme foulness of this piece of land requiring what in few instances would be necessary;) and to cart and spread sixty loads of compost per acre, and to complete the whole by the 20th September.

The beans weighed four stone nine pounds per Winchester bushel. The straw I conceive to be preferable to oat straw.

The expences I have stated below: should your Lordship wish for any further information, or a sample of the beans, I shall have much pleasure in obeying your commands.

And have the honour to be, &c.

J. C. Curwen.

Expence of Removal.

Men's work, 27 days at 2*s.*			2 14 0
Women's ditto, 30 days at 9*d.*			1 2 6
Horses ditto, 27 days at 3*s.*			4 1 0
		£7	17 6
Expence of putting in the beans, at 2 Winchesters per acre, &c.	42 5 6		
Cleaning, &c. &c. &c. for 3 months	56 0 6		
Reaping, removing, stacking, &c.	35 8 3		
		133	14 3
The crop consisted of 2010 stooks, and are supposed to yield 10 quarts per stook, or 628 Winchesters, at 5*s.* 4*d.*		167	9 4
Balance in favour of crop		33	15 1
To further expences after taking off the beans, and previous to putting in the wheat		57	8 0
To summer fallow at £1. 16*s.* 0*d.* per acre	75 12 0		
To balance, suppose the wheat sown, as in most cases it would be, on cutting the beans	33 15 1		
		109	7 1
By going over a dead fallow		51	18 11

The beans cut and bound covered about two acres of land. Expence of removal 4*s.* per acre.

The crop I calculate by what is threshed to produce 600 Winchester bushels.

No. XXIV.

Account of some Cottagers. *By* Thomas Babington, *Esq. M. P.*

For many years previous to 1797, I had set small pieces of land in two parishes near my place of residence to a few cottagers and village-tradesmen (carpenters, masons, &c.), who were thereby enabled to keep from one to three milch cows each, and to supply their families abundantly with culinary vegetables. I thought I saw such good effects from pursuing that plan, that in 1797 I extended it considerably, and have now twenty-six tenants of the above description within two miles of my house. Four of them joist their cows, from Lady-day to Martinmas, in a close which I have in my own occupation. Part of these rent small pieces of meadow of me, from which they cut hay for the winter; and part purchase hay where they can. Twenty-two rent of me from three to twelve or fourteen acres each, consisting partly of up-land, and partly of meadow. I have found materials for such as wished to build a cow hovel each in their upland closes; and all have done so, except those who had conveniences for housing their cows at home. In order to obtain a sufficient number of upland closes of a proper size, I divided some grounds of fifteen or twenty acres each into smaller ones, by quicksets well fenced; and I required those, to whom I let them, to take care of the new fences, until they should be raised. Part of the meadow land set to these tenants has been divided by fences, so that each has his own portion in severalty through the year. Part has merely been divided by landmarks, which fix the boundaries of the pieces from which they are respectively to cut their hay, and in the autumn they stock the aftermath of the whole meadow in common, each turning in his due proportion of cows on a day fixed by me; and the meadow is also cleared of stock on a day of my appointing. I find, however, that they like so much better to have their pieces of meadow land entirely separate, each to himself, than to stock the aftermath of a large meadow in common, that new divisions of meadow are made yearly, and in a short time probably each man will have his own piece in severalty.

The land I let to these persons is good and proper for their purpose. The upland closes are seldom half a mile from their habitations. The meadow ground is in some instances further; but this is of the less importance, as the cows are not in the meadows more than six or eight weeks in the year, and consequently the inconvenience of going to a distance to milk does not continue long.

Had I not been able to provide them with meadow, experience in one or two instances has shewn me, that three small and contiguous upland closes, to be mown in turns, would have answered the purpose of one of these tenants very well. Their rents are as high as those paid by the farmers in the same parishes, and are paid with remarkable punctuality.

I am fully convinced, that persons of this description can well afford to pay as high rents as farmers, for land which suits their purpose.

The wives and daughters milk and manage the cows, with occasional assistance from their husbands; but the latter are not prevented from working for their masters the farmers, or pursuing their trades, with great regularity, through the year, except for about a week in hay harvest; and for a few days at other times, when the carrying of their manure, or some work which the women cannot perform, demands their attention. Such of them as are not tradesmen, are among the most respectable and useful of the farmers' labourers. It is important, for obvious reasons, not to set so much land to the class of persons of which I am speaking, as to interrupt materially the course of their ordinary occupations.

The system I have described appears to me to produce great advantages *to the individuals who occupy the land, to the landlord, and to the community.*

The occupiers of the land get, I think, a clear profit from it equal to from £4. to £8. on every cow they keep. Those who keep two cows (which is the case with the greater part) are richer by at least £10. a year, than they would be had they no land; exclusive of the advantage they derive from raising potatoes, and other vegetables for their families and pigs, which cannot be estimated at less than from £1. to £3. per annum. This increase of income adds prodigiously to the comforts of a cottager's, or village-tradesman's family; comforts which are further augmented by the nature of the articles produced by their land. They obtain from it for their children, milk, which is generally procured with much difficulty by the village poor; and for a hog, whey and buttermilk, which with offal, potatoes, and cabbages, enable them to keep one of the most useful animals a poor man can possess. They

are still more benefitted by the improvement of their habits, than they are by the increase of their comforts. When they have a little spare time, the men go to their land and their stock, rather than to the alehouse: and the women employ many hours in the care of their cows and dairies, which would be otherwise worse than lost in idleness and gossiping. Their characters are also improved by their endeavours to maintain the good opinion of their landlord; by their attachment to good order, in proportion as they become possessed of property, and enjoy its advantages; and by the prospect they have of supporting their families without ever having recourse to parochial relief, and of seeing their children well brought up, and respectable in life. The children are healthy from the good food they enjoy; they are more likely to have proper school instruction than those of poorer families, and they naturally copy the good habits of their parents.

The landlord is benefitted in various ways, by thus contributing to better the condition of the poor. My land in the hands of the labouring classes has improved faster, than that occupied by the generality of my more wealthy tenants. The former have always plans on foot for increasing the fertility of their little spots. The tendency which the system I have described has to lessen the poor rate, by lessening the number of the poor likely to become chargeable, is also no despicable advantage to the land owners, who ultimately pays all the charges on his land. But the most important benefits he receives, are of a different kind: he has the consciousness of affording an opportunity, to the more deserving class of the poor on his estate, to exert their industry, and to employ their little capital to the best advantage; and of thereby adding essentially to their comforts, of improving their morals and habits, and of raising them to a higher rank in society. He has the satisfaction of encouraging merit, not only in those who are, but in those who wish to be, his tenants; and he makes it respectable in the eyes of those, who are disinterested spectators of his conduct. He can scarcely fail to enjoy, if he proceeds with consistency and discretion, the respect and attachment of a numerous and important description of persons on his estates, with whom, if all his land were set to farmers, he would have a very slender connexion.

While the parties immediately concerned are thus benefitted, the community at large is by no means without its share of advantage. The productions of the earth are increased by its being made the immediate interest of the poor, to whom every little gain is of importance to increase them. Industry and health are promoted by

pleasing and salutary employments, which the cultivation of their own land, and the preparing of its produce for market, afford them. Economy is studied, when they experience to how good an account savings may be turned. When milk is in so many hands, it is more easily purchased, and thus an essential accommodation is afforded to the village-poor in general. An important addition is made to that useful class of men, the labour of whose hands fully supplies them with necessaries and decent comforts, and whose well employed capital and good habits render them a robust and flourishing peasantry, above dependance on a parish, but not above regular labour. A new description of men obtain an interest in the soil, and feel themselves raised above the common lot of the poor, who are generally obliged to depend solely on their weekly or yearly wages: they therefore become deeply interested in the stability of property, and the maintenance of good order; and are likely to feel an affection for a government, under which they find themselves thriving and happy.

I have not had sufficient experience of a tenantry, consisting of the labouring classes, to see the above picture of the benefits resulting from it fully realized in all its parts. It has, however, been so far realized on my property, that I can have no doubt as to its being a fair one. I must be understood to speak of the *general effects* of the system I have described. Among a number of tenants, there will be great varieties of conduct, and in some instances the landlord will probably meet with disappointments; but if he gives the system a fair trial, I am pretty certain that he will not see cause to abandon it.

I have found farmers considerably prejudiced against land being set to labourers and mechanics. Even such of them as are respectable and well meaning men are not sparing of prophecies of various kinds inimical to that system; and partly by their weight of character with the landlord, and partly by their confident assertions, they often succeed, I fear, in preventing it from being adopted. If they have influence with their landlord, they have for obvious reasons commonly more with his steward; and indeed the steward himself is not seldom tinctured with their prejudices, and ready to use their arguments, without being prompted to do so.

I have found all their prophecies of backward rents,—ruined tenants,—spoilt labourers and mechanics,—and endless trouble to myself, entirely fail.

One evil (and it is the only one of which I am aware) has resulted from my

setting land to the labouring class. Some of the men have been inclined to spend too much time in looking at their grounds and stock on a Sunday.

A temptation to this evil is inseparable, from a system so highly interesting to those for whose benefit it is introduced. However, the influence of the landlord is great, and it ought to be exerted for the prevention, or the cure of a habit, which would be equally irreconcilable with duty, and hostile to true happiness.

As I wished to extend the benefit arising from the occupation of land, as far as I could to the decent and orderly poor; and as many of that description were not able to purchase a cow, I last year introduced the plan of setting to such of them small plots of ground for the planting of potatoes. Most of them had their choice between a quarter of a rood and half a rood each: the generality preferred the former quantity. This might be partly owing to the very high price of seed-potatoes. About four acres of a fallow close, conveniently situated, and of a good and proper soil were divided into beds, each of the width of twelve yards, with paths between them; and the beds were divided into about sixty plots for an equal number of householders. They in general cultivated their respective portions with care, and chiefly during their spare hours, the women and children taking their share in the work, and got good crops, of which I received three bushels for every quarter of a rood, as rent. This rent was paid very punctually and cheerfully. The produce of each quarter of a rood was on an average about twenty bushels; but it varied very greatly, being in some instances as low as eleven or twelve, and in others as high as thirty bushels. The poor who were thus accommodated, are very desirous of having ground for potatoes in future. The advantages of this system are similar to those of furnishing cottagers with land for cows, though inferior to them in magnitude. In one particular, the benefit arising from enabling the poor man to furnish himself with potatoes by his own labour, and that of his wife and children, is very striking. His heap of potatoes is a resource under temporary calamities, which must otherwise oblige him to apply for parochial relief; and in this way it not only lessens the poor's-rate, but, what is more important, proves no mean guard of those valuable qualities, which are generally impaired, if not destroyed, by dependance on a parish.

It is no small recommendation of this plan, that it may be adopted by almost every gentleman of landed property in each of his parishes with very little difficulty. A very few acres of ground are sufficient for the accommodation of the poor of a

large parish in this way; and what hardship can it be on any considerable farmer, to be required by his landlord to give up four or five acres for the benefit of perhaps sixty poor families around him?

The furnishing labourers and mechanics with land for cows will generally be attended with more trouble. A much larger quantity of ground is wanted for this purpose; and if a gentleman has not a farm in his own hands, which may enable him to supply it, or to make such exchanges with his farmers as will accommodate them, at the same time that he obtains from them land which will suit the poor; he will meet with numerous objections to every plan he can form. It is probable, that all the farmers on his estate will object to the taking twenty or thirty acres from their farms for the use of the poor, with almost as much zeal and anxiety, as if the land were their own freehold property. However unwilling a humane landlord must be to adopt any measure prejudicial to the interests, or grating to the feelings of his tenants; yet when he considers, that *all* who live on his estate are entitled to his attention, and that by every three acres of land (or thereabouts) which a farmer parts with, the family of a labourer, equal in merit perhaps to that of the farmer, is provided with keep for a cow, he may see good ground for insisting on his farmers making some sacrifices in favour of the system he wishes to introduce.

When a sufficient quantity of proper land is procured, the great difficulty is surmounted, and the landlord must make his choice between the plan of providing a common pasture, and a common meadow for the use of those whom he wishes to accommodate; and that of dividing and appropriating the land in such a way, that each individual may have (as far as regards upland at least) his own peculium. The former plan will be introduced with the least expence and trouble to himself; but the latter is so much more pleasing to the poor, and so obviously tends to the improvement of his estate, that he will probably slide into it by degrees; though he should begin with the other, and will divide off portions of land from time to time for particular individuals.

After the establishment of plans for enabling the poor to keep cows, and plant potatoes, some petty regulations will yearly, or more frequently, require attention. If the landlord does not live on the spot, or finds it inconvenient to give that attention himself, a discreet and humane tenant may supply his place. Let it, however, be remembered, that many and great advantages arise from gentlemen taking an active part themselves in their plans for the benefit of the poor.

P. S. The pecuniary advantages derived by the poor from taking ground in the way that has been above described for planting potatoes, may perhaps be placed in a strong point of view by the following fact. It is customary for the farmers to let their labourers plant potatoes in the corners of their corn fields, on condition that the farmer and labourer should divide the crop equally. Now in this case, from every quarter of a rood of ground so planted, the farmer receives about ten bushels of potatoes, while I receive three bushels from that quantity of ground. In other words, the rent paid by the cottager to the farmer is more than three times as much as is paid to me, though my rent is a fair rent for the land. Whether the farmer finds half the seed or not, I am not certain; but if he does, still his rent will be at least treble mine: and yet even under this immense disadvantage, the cottager is glad to plant potatoes in the farmer's fields on the above terms. If land were held permanently for planting potatoes, a small cart load of manure, being about the quantity which accumulates at every cottager's door every year from his ashes, &c. ought to be taken to it, and would keep it in good fertility.

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Mr. Babington desired the Secretary of the Board to add to this Postscript, that no person who keeps a cow has been chargeable to the parish, not even in the scarcities.

No. XXV.

A short Account of the Cause of the Disease in Corn, called by Farmers the Blight, the Mildew, and the Rust. *By the Right Hon. Sir* Joseph Banks, *Bart. K. B. P. R. S.*

Botanists have long known that the blight in corn is occasioned by the growth of a minute parasitic fungus or mushroom on the leaves, stems, and glumes of the living plant. Felice Fontana published in the year 1767 an elaborate account of this mischievous weed,* with microscopic figures, which give a tolerable idea of its form; more modern botanists † have given figures both of corn and of grass affected by it, but have not used high magnifying powers in their researches.

Agriculturists do not appear to have paid, on this head, sufficient attention to the discoveries of their fellow-labourers in the field of nature; for though scarce any English writer of note on the subject of rural economy has failed to state his opinion of the origin of this evil, no one of them has yet attributed it to the real cause, unless Mr. Kirby's excellent papers on some diseases of corn, published in the Transactions of the Linnæan Society, are considered as agricultural essays.

On this account it has been deemed expedient to offer to the consideration of farmers, engravings of this destructive plant, made from the drawings of the accurate and ingenious Mr. Bauer, Botanical Painter to his Majesty, accompanied with his explanation, from whence it is presumed an attentive reader will be able to form a correct idea of the facts intended to be represented, and a just opinion whether or not they are, as is presumed to be the case, correct and satisfactory.

In order, however, to render Mr. Bauer's explanation more easy to be understood, it is necessary to premise, that the striped appearance of the surface of a straw which may be seen with a common magnifying glass, is caused by alternate longitudinal partitions of the bark, the one imperforate, and the other furnished with one

* Osservazioni sopra la Ruggine del Grano. Lucca, 1767, 8vo.

† Sowerby's English Fungi, Vol. II. Tab. 140, Wheat, Tab. 139. Poa aquatica.

or two rows of pores or mouths, shut in dry, open in wet weather, and well calculated to imbibe fluid whenever the straw is damp.*

By these pores, which exist also on the leaves and glumes, it is presumed that the seeds of the fungus gain admission, and at the bottom of the hollows to which they lead, (See Plate XIII. fig. 1, 2,) they germinate and push their minute roots, no doubt (though these have not yet been traced) into the cellular texture beyond the bark, where they draw their nourishment, by intercepting the sap that was intended by nature for the nutriment of the grain; the corn of course becomes shrivelled in proportion as the fungi are more or less numerous on the plant; and as the kernel only is abstracted from the grain, while the cortical part remains undiminished, the proportion of *flour to bran* in blighted corn, is always reduced in the same degree as the corn is made light. Some corn of the last year's crop will not yield a stone of flour from a sack of wheat; and it is not impossible that in some cases the corn has been so completely robbed of its flour by the fungus, that if the proprietor would choose to incur the expence of thrashing and grinding it, bran would be the produce, with scarce an atom of flour for each grain.

Every species of corn, properly so called, is subject to the blight; but it is observable that spring corn is less damaged by it than winter, and rye less than wheat, probably because it is ripe and cut down before the fungus has had time to increase in any large degree.—Tull says that " white cone or bearded wheat, which hath its straw like a rush full of pith, is less subject to blight than Lammas wheat, which ripens a week later." See page 74. The spring wheat of Lincolnshire was not in the least shrivelled last year, though the straw was in some degree infected: the millers allowed that it was the best sample brought to market. Barley was in some places considerably spotted, but as the whole of the stem of that grain is naturally enveloped in the hose or basis of the leaf, the fungus can in no case gain admittance

* Pores or mouths similar to these are placed by nature on the surface of the leaves, branches, and stems, of all perfect plants, a provision intended no doubt to compensate, in some measure, the want of loco-motion in vegetables. A plant cannot when thirsty go to the brook and drink, but it can open innumerable orifices for the reception of every degree of moisture, which either falls in the shape of rain and of dew, or is separated from the mass of water always held in solution by the atmosphere; it seldom happens in the driest season, that the night does not afford some refreshment of this kind, to restore the moisture that has been exhausted by the heats of the preceding day.

to the straw; it is however to be observed, that barley rises from the flail lighter this year than was expected from the appearance of the crop when gathered in.

Though diligent inquiry was made during the last autumn, no information of importance relative to the origin or the progress of the blight could be obtained: this is not to be wondered at; for as no one of the persons applied to had any knowledge of the real cause of the malady, none of them could direct their curiosity in a proper channel. Now that its nature and cause have been explained, we may reasonably expect that a few years will produce an interesting collection of facts and observations, and we may hope that some progress will be made towards the very desirable attainment of either a preventive or a cure.

It seems probable that the leaf is first infected in the spring, or early in the summer, before the corn shoots up into straw, and that the fungus is then of an orange colour;* after the straw has become yellow, the fungus assumes a deep chocolate brown: each individual is so small, that every pore on a straw will produce from twenty to forty fungi, as may be seen in the Plates, and every one of these will no doubt produce at least an hundred seeds; if then one of these seeds tillows out into the number of plants that appear at the bottom of a pore in Plate XIII. fig. 1, 2, how incalculably large must the increase be! A few diseased plants scattered over a field must very speedily infect a whole neighbourhood, for the seeds of fungi are not much heavier than air, as every one who has trod upon a ripe puff-ball must have observed by seeing the dust, among which is its seed, rise up and float on before him.

How long it is before this fungus arrives at puberty, and scatters its seeds in the wind, can only be guessed at by the analogy of others; probably the period of a generation is short, possibly not more than a week in a hot season: if so, how frequently in the latter end of the summer must the air be loaded as it were with this animated dust, ready, whenever a gentle breeze, accompanied with humidity, shall give the signal to intrude itself into the pores of thousands of acres of corn. Providence, however, careful of the creatures it has created, has benevolently provided against the too extensive multiplication of any species of being; was it otherwise,

* The Abbé Tessier in his Traité des Maladies des Grains, tells us, that in France this disease first shews itself in minute spots of a dirty white colour on the leaves and stems, which spots extend themselves by degrees, and in time change to a yellow colour, and throw off a dry orange-coloured powder, p. 201, 340.

the minute plants and animals, enemies against which man has the fewest means of defence, would increase to an inordinate extent; this, however, can in no case happen, unless many predisposing causes afford their combined assistance. But for this wise and beneficent provision, the plague of slugs, the plague of mice, the plagues of grubs, wire-worms, chafers, and many other creatures whose power of multiplying is countless as the sands of the sea, would, long before this time, have driven mankind, and all the larger animals, from the face of the earth.

Though all old persons who have concerned themselves in Agriculture remember the blight in corn many years, yet some have supposed that of late years it has materially increased: this however does not seem to be the case. Tull, in his Horse-hoeing Husbandry, p. 74, tells us, that the year 1725 "was a year of blight, the like of which was never before heard of, and which he hopes may never happen again;" yet the average price of wheat in the year 1726, when the harvest of 1725 was at market, was only 36*s.* 4*d.* and the average of the five years of which it makes the first, 37*s.* 7*d.*—1797 was also a year of great blight; the price of wheat in 1798 was 49*s.* 1*d.* and the average of the five years, from 1795 to 1799, 63*s.* 5*d.**

The climate of the Bristish Isles is not the only one that is liable to the blight in corn; it happens occasionally in every part of Europe, and probably in all countries where corn is grown. Italy is very subject to it, and the last harvest of Sicily has been materially hurt by it. Specimens received from the colony of New South Wales shew that considerable mischief was done to the wheat crop there in the year 1803 by a parasitic plant, very similar to the English one.

It has been long admitted by farmers, though scarcely credited by botanists, that wheat in the neighbourhood of a barberry bush seldom escapes the blight. The village of Rollesby in Norfolk, where barberries abound, and wheat seldom succeeds, is called by the opprobrious appellation of Mildew Rollesby. Some observing men

* The scarcity of the year 1801, was in part occasioned by a mildew, which in many places attacked the plants of wheat on the SE. side only; but it was principally owing to the very wet harvest of 1800. The deficiency of wheat at that harvest was found, on a very accurate calculation, somewhat to exceed one-fourth; but wheat was not the only grain that failed, all others, and potatoes also, were materially deficient. The wheat of the last crop is probably somewhat more damaged than it was in 1800, and barley somewhat less than an average crop; every other article of agricultural food is abundant, and potatoes one of the largest crops that has been known; but for these blessings upon the labour of man, wheat must before this time have reached an exorbitant price.

have of late attributed this very perplexing effect to the farina of the flowers of the barberry, which is in truth yellow, and resembles in some degree the appearance of the rust, or what is presumed to be the blight in its early state.

It is, however, notorious to all botanical observers, that the leaves of the barberry are very subject to the attack of a yellow parasitic fungus, larger, but otherwise much resembling the rust in corn.

Is it not more than possible that the parasitic fungus of the barberry and that of wheat are one and the same species, and that the seed is transferred from the barberry to the corn? Misletoe, the parasitic plant with which we are the best acquainted, delights most to grow on the apple and hawthorn, but it flourishes occasionally on trees widely differing in their nature from both of these: in the Home Park, at Windsor, misletoe may be seen in abundance on the lime trees planted there in avenues. If this conjecture is founded, another year will not pass without its being confirmed by the observations of inquisitive and sagacious farmers.

It would be presumptuous to offer any remedy for a malady, the progress of which is so little understood; conjectures, however, founded on the origin here assigned to it, may be hazarded without offence.

It is believed* to begin early in the spring, and first to appear on the leaves of wheat in the form of rust, or orange-coloured powder; at this season, the fungus will, in all probability, require as many weeks for its progress from infancy to puberty, as it does days during the heats of autumn; but a very few plants of wheat, thus infected, are quite sufficient if the fungus is permitted to ripen its seed, to spread the malady over a field, or indeed over a whole parish.

The chocolate-coloured blight is little observed till the corn is approaching very nearly to ripeness; it appears then in the field in spots, which increase very rapidly in size, and are in calm weather somewhat circular, as if the disease took its origin from a central position.

May it not happen, then, that the fungus is brought into the field in a few stalks of infected straw uncorrupted among the mass of dung laid in the ground at the time of sowing? it must be confessed, however, that the clover lays, on which no dung from the yard was used, were as much infected last autumn as the manured crops. The immense multiplication of the disease in the last season, seems however to

* This, though believed, is not dogmatically asserted, because Fontana, the best writer on the subject, asserts that the yellow and the dark-coloured blight are different species of fungi.

account for this; as the air was no doubt frequently charged with seed for miles together, and deposited it indiscriminately on all sorts of crops.

It cannot however be an expensive precaution to search diligently in the spring for young plants of wheat infected with the disease, and carefully to extirpate them, as well as all grasses, for several are subject to this or a similar malady, which have the appearance of orange-coloured or of black stripes on their leaves, or on their straw; and if experience shall prove that uncorrupted straw can carry the disease with it into the field, it will cost the farmer but little precaution to prevent any mixture of fresh straw from being carried out with his rotten dung to the wheat field.

In a year like the present, that offers so fair an opportunity, it will be useful to observe attentively whether cattle in the straw-yard thrive better or worse on blighted than on healthy straw. That blighted straw, retaining on it the fungi that have robbed the corn of its flour, has in it more nutritious matter than clean straw which has yielded a crop of plump grain, cannot be doubted; the question is, whether this nutriment in the form of fungi does, or can be made to agree as well with the stomachs of the animals that consume it, as it would do in that of straw and corn.

It cannot be improper in this place to remark, that although the seeds of wheat are rendered, by the exhausting power of the fungus, so lean and shrivelled that scarce any flour fit for the manufacture of bread can be obtained by grinding them, these very seeds will, except, perhaps, in the very worst cases,* answer the purpose of seed corn as well as the fairest and plumpest sample that can be obtained, and, in some respects better; for as a bushel of much blighted corn will contain one-third at least more grains in number than a bushel of plump corn, three bushels of such corn will go as far in sowing land, as four bushels of large grain.

The use of the flour of corn in furthering the process of vegetation, is to nourish the minute plant from the time of its developement till its roots are able to attract food from the manured earth; for this purpose one-tenth of the contents of a grain of good wheat is more than sufficient. The quantity of flour in wheat has been

* Eighty grains of the most blighted wheat of the last year, that could be obtained, were sown in pots in the hot-house; of these, seventy-eight produced healthy plants, a trifling loss. An excellent experimental paper on this very interesting subject by Mr. Machie, of Ormiston, near Edinburgh, was first printed in the Edinburgh Courant, for March 21, 1805, and is reprinted in Mr. Young's Annals of Agriculture.

increased by culture and management calculated to improve its qualities for the benefit of mankind, in the same proportion as the pulp of apples and pears has been increased, by the same means, above what is found on the wildings and crabs in the hedges.

It is customary to set aside or to purchase for seed corn, the boldest and plumpest samples that can be obtained; that is, those that contain the most flour; but this is unnecessary waste of human subsistence; the smallest grains, such as are sifted out before the wheat is carried to market, and either consumed in the farmer's family, or given to his poultry, will be found by experience to answer the purpose of propagating the sort from whence they sprung, as effectually as the largest.

Every ear of wheat is composed of a number of cups placed alternately on each side of the straw; the lower ones contain, according to circumstances, three or four grains, nearly equal in size, but towards the top of the ear, where the quantity of nutriment is diminished by the more ample supply of those cups that are nearer the root, the third or fourth grain in a cup is frequently defrauded of its proportion, and becomes shrivelled and small. These small grains, which are rejected by the miller, because they do not contain flour enough for his purpose, have nevertheless an ample abundance for all purposes of vegetation, and as fully partake of the sap, (or blood, as we should call it in animals,) of the kind which produced them, as the fairest and fullest grain that can be obtained from the bottoms of the lower cups by the wasteful process of beating the sheaves.

EXPLANATION OF THE PLATES.

PLATE XII.

Fig. 1. A piece of the infected wheat straw—natural size: at *a* the leaf-sheath is broken and removed, to shew the straw which is not infected under it.

Fig. 2. A highly magnified representation of the parasitic plant which infects the wheat: *a* in a young state; *b* full grown; *c* are two plants bursting and shedding their seeds when under water in the microscope; *d* two plants burst in a dry state; *e* seems to be abortive; *f* seeds in a dry state; *g* a small part of the bottom of a pore with some of the parasitic fungi growing upon it.

Fig. 3. A part of the straw of fig. 1, magnified.

Fig. 4. Part of fig. 3 at *a b* more magnified.

Fig. 5. Part of a straw similar to fig. 3, but in its green state, and before the parasitic plant is quite ripe.

Fig. 6. A small part of the same, more magnified.

PLATE XIII.

Fig. 1. A highly magnified transverse cutting of the straw, corresponding with fig. 4. Plate XII. shewing the insertion of the parasite in the bark of the straw.

Fig. 2. A longitudinal cutting of the same; magnified to the same degree.

Fig. 3. A small piece of the epidermis of a straw, shewing the large pores which receive the seed of the parasite; the smaller spots observable on the epidermis, are the bases of hairs that grow on the plant of the wheat whilst young, but which fall off when it ripens, magnified to the same degree as the preceding figures.

Drawn by

Communicated to the Bd of Agriculture Vol. IV page 406

Plate XI



Fig. 1.

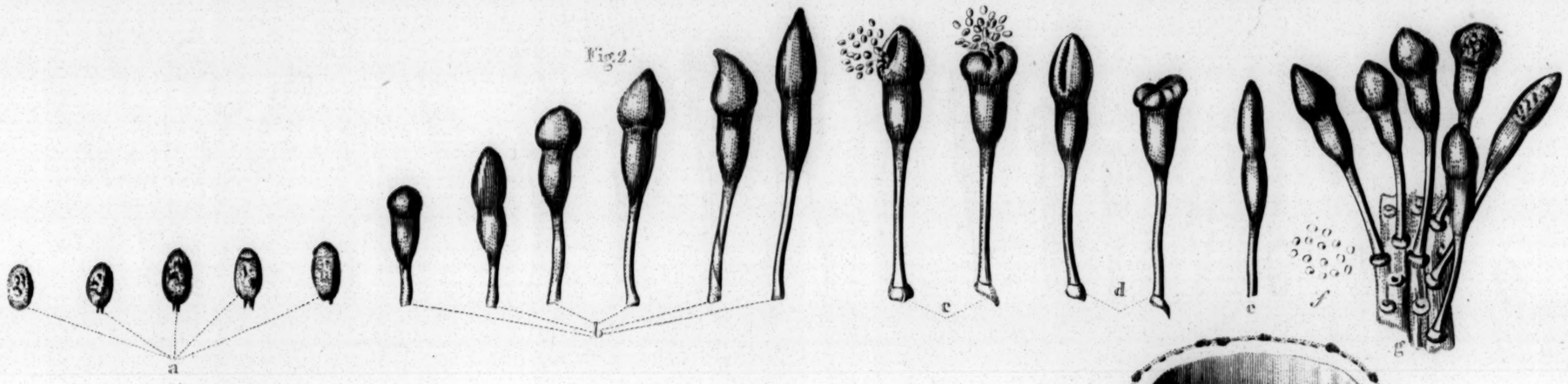


Fig. 2.

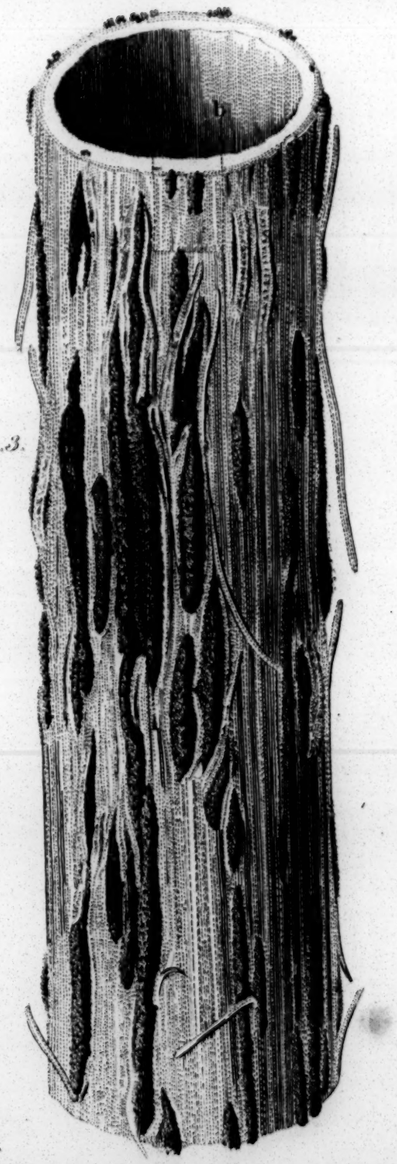


Fig. 3.

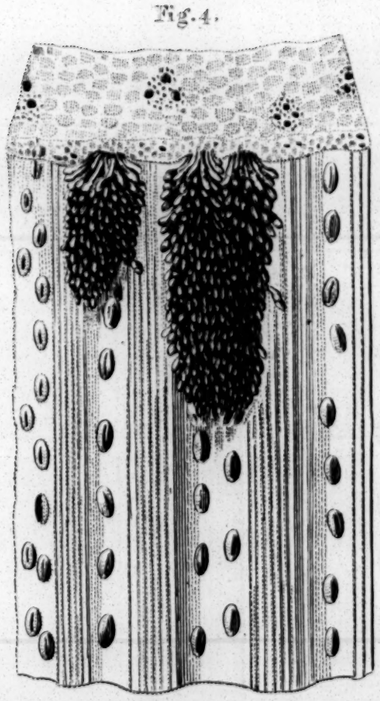


Fig. 4.

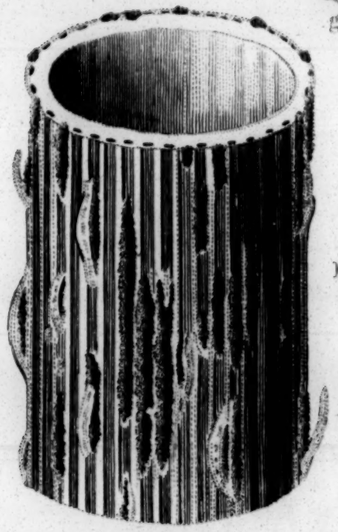


Fig. 5.

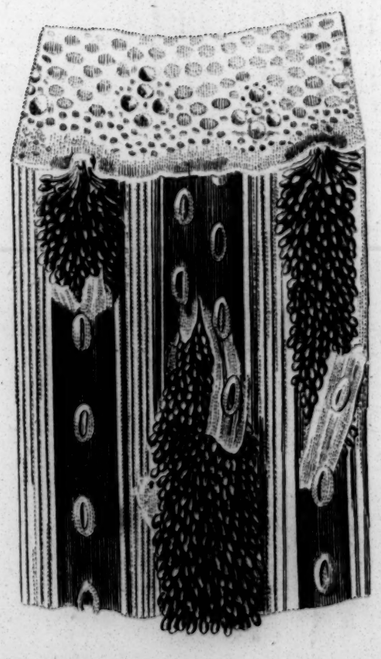


Fig. 6.

Drawn by Francis Bauer.

Engraved by F. Sansom

Plate XII

Fig. 1.

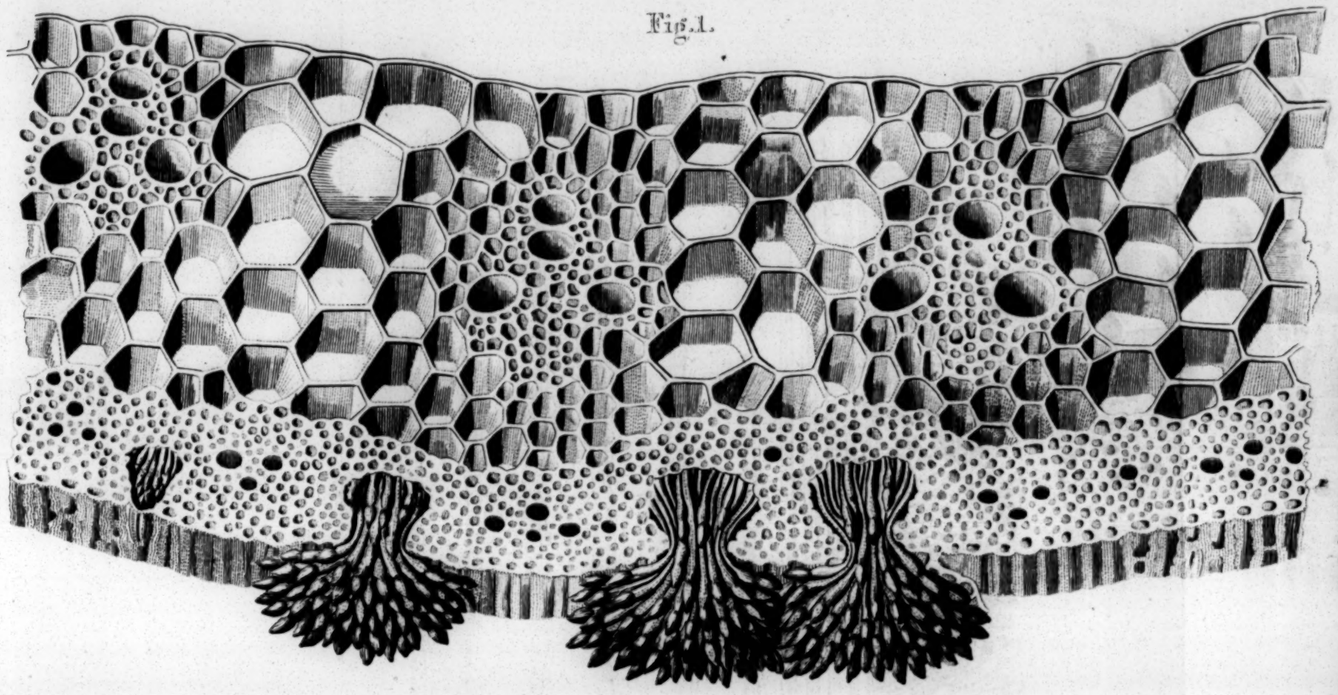


Fig. 2.

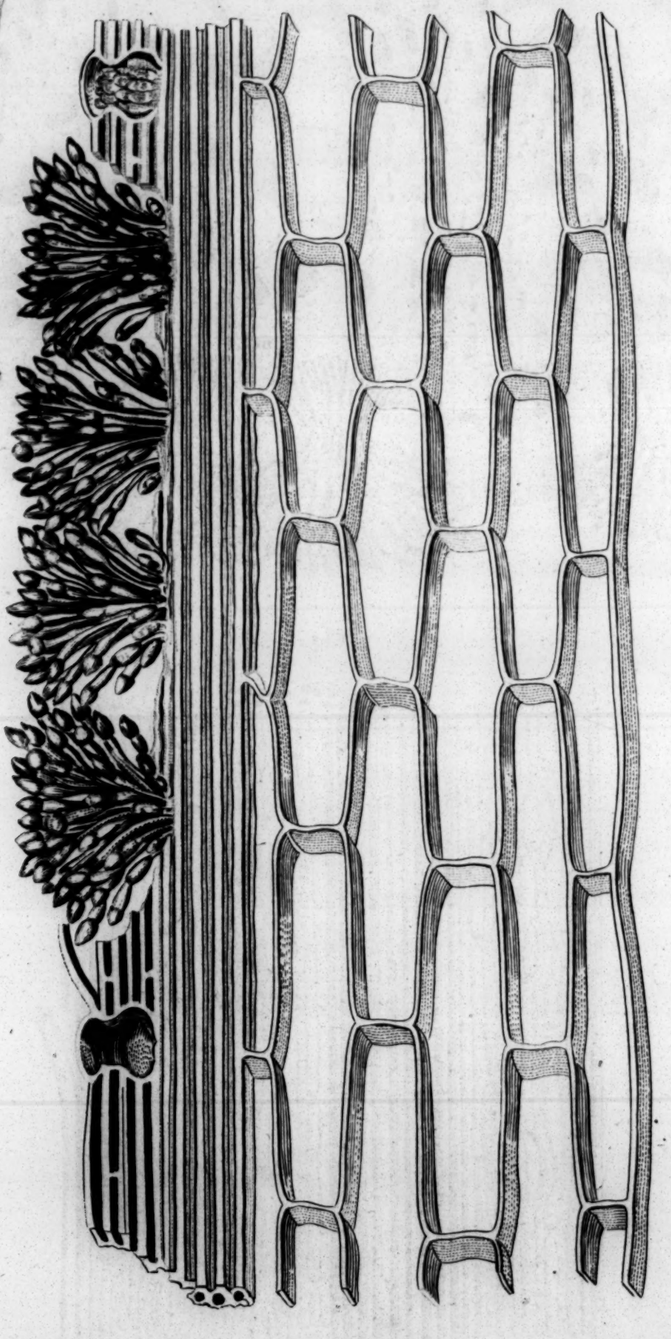
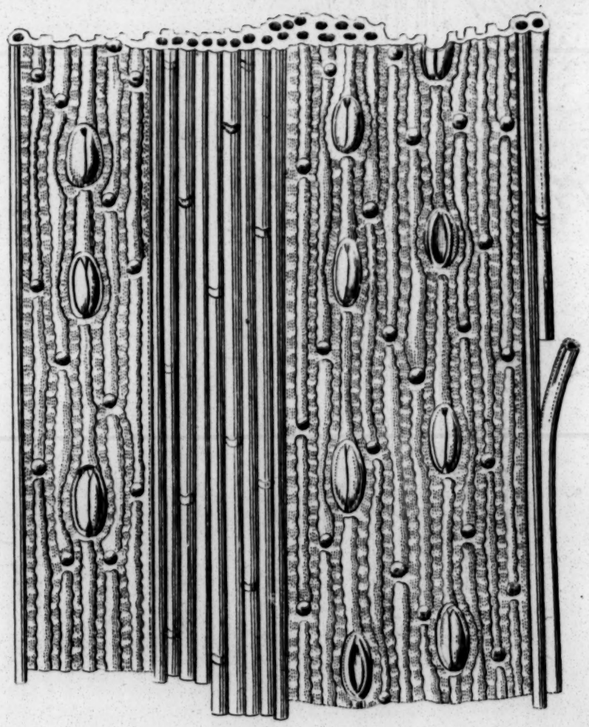


Fig. 3.



Drawn by Francis Bauer.

Engraved by F. Sansom.



Plate XIII

Fig. 1.

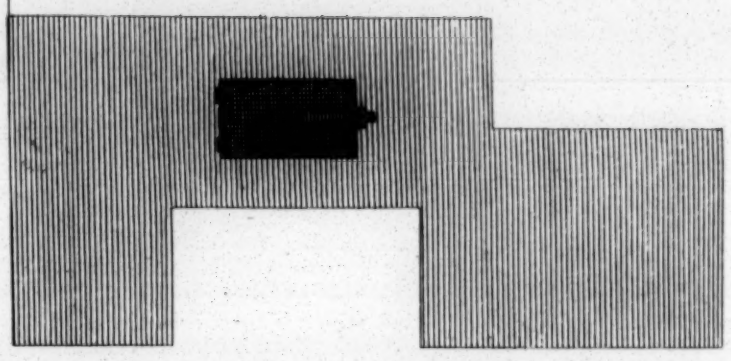


Fig. 4.

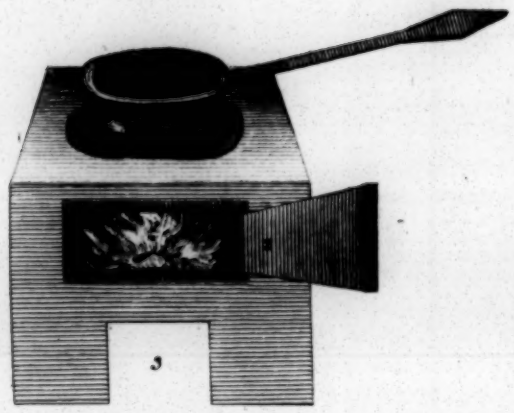


Fig. 2.

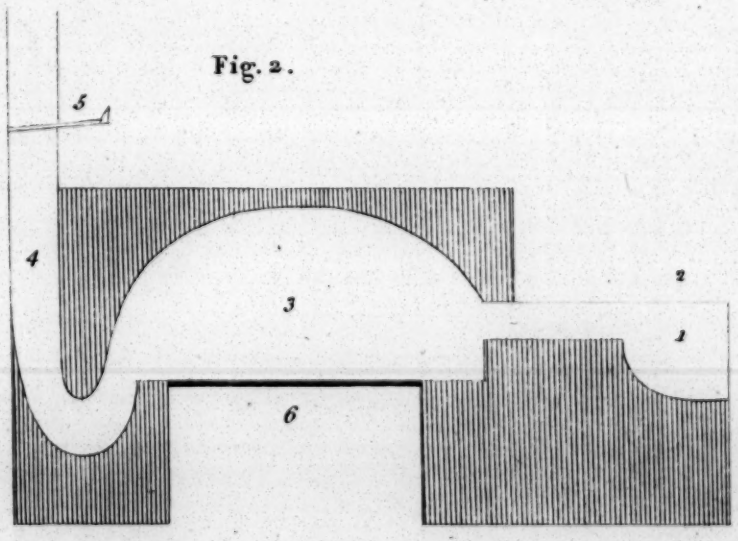


Fig. 3.

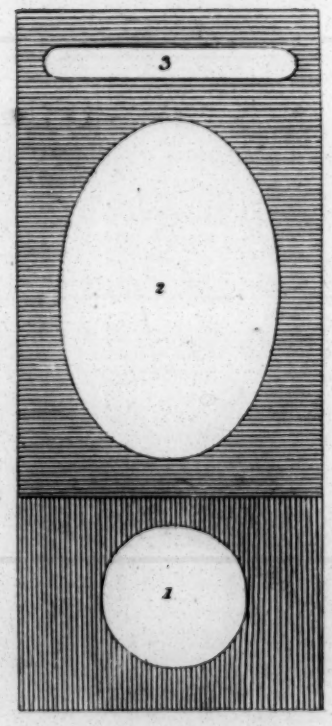


Fig. 1. *Is a Side View of the Oven, with the Oven Door.*

Fig. 2. *Section of the same on Horizontal Plan.*

1. *Is the Fire place.*
2. *Is an Iron plate in which a circular piece is cut out, & occasionally taken off to admit a boiler over the Fire.*
3. *the Oven.*
4. *Chimney Flue.*
5. *Regulator of D°*
6. *Plate of Iron at the bottom of the Oven.*

Fig. 3.

1. *Plate of Iron which is occasionally removed.*
2. *the Form of the Oven.*
3. *the Chimney Flue.*

Fig. 4. *Front View of D°*

1. *Fire Place.*
2. *Door to the fire place.*
3. *Ash pit.*
4. *Pot or boiler.*

Neele sculp Strand.

Plate XIII

Fig. 1.

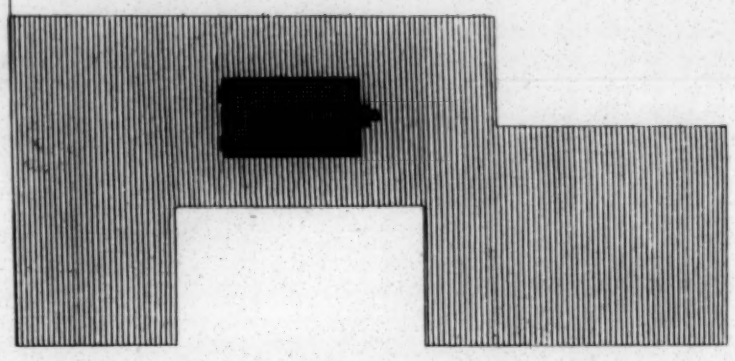


Fig. 4.

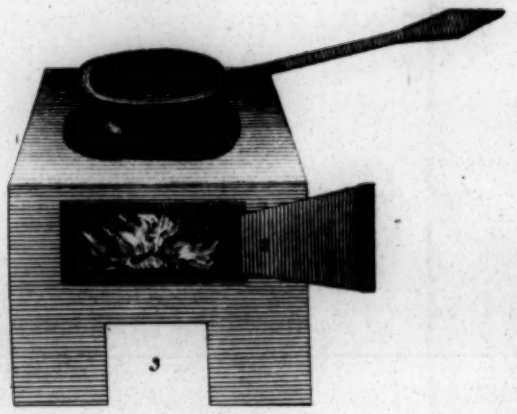


Fig. 2.

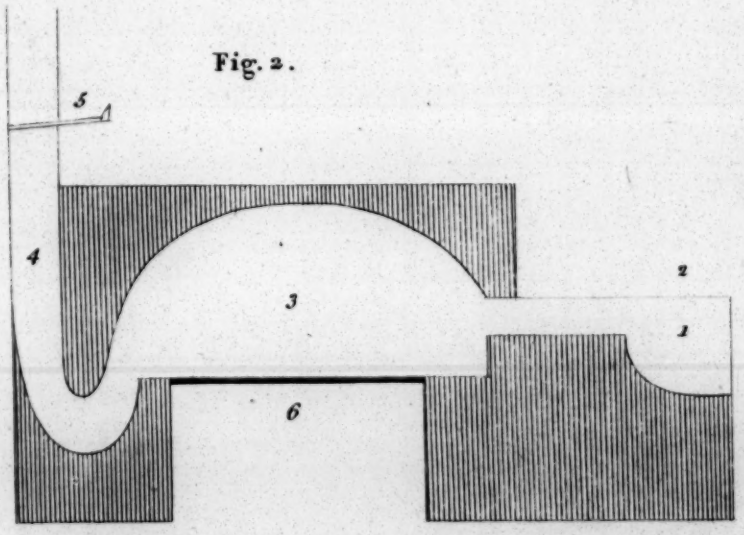


Fig. 3.

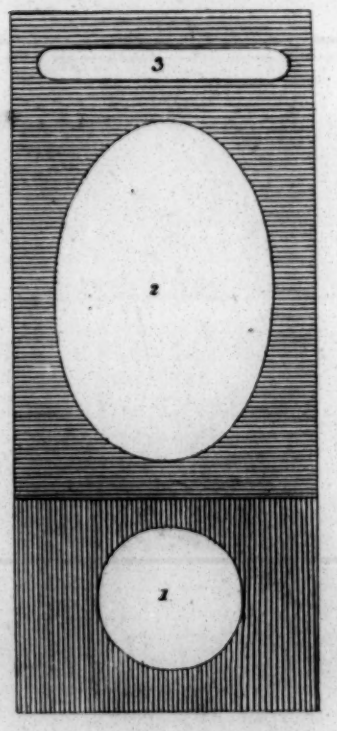


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Fig. 4. *Front View of Dº*

1. *Fire Place.*
2. *Door to the fire place.*
3. *Ash pit.*
4. *Pot or boiler.*

Neele sculp Strand.



No. XXVI.

Experiments in Agriculture. By Mr. John Wright, *of Pickworth, Rutlandshire.*

In a memoir on the conversion of grass and arable land, Mr. Wright mentioned his readiness to try any experiment that might be recommended by the Board of Agriculture, without their incurring any other expense than the mere loss (should there be any loss) attending the trials. In consequence of this offer, the following experiment was recommended to Mr. Wright by letter, dated 11th of May, 1802.

" To mark out three pieces contiguous, each containing the eighth part of an acre, the soil, and all circumstances except manuring, to be exactly similar.

" To manure one with three tons of long fresh stable dung, not more than a few days old, quite in a straw state.

" Another with two tons of rotten stable dung, six, eight, or nine months old, of the same quality respecting the food of the horses.

" The third, to spread on it equally in every part fifteen hundred weight, or three quarters of a ton of any sort of straw that is quite dry, and to set fire to it, and burn it to ashes, and immediately plough shallow, and sow the turnip seed.

" And adjoining an unmanured eighth, for comparison.

" The two sorts of dung to be turned in clean, and well covered, especially the long dung, so as to have none lying out at the seams of the furrows."

Soil.

A reddish gravel mixed with limestone, and a few pebbles incumbent on a lime stone rock at the depth of twelve inches adjoining an old barren heath, of which it was a part, a worse soil than it appears to be. Sown with turnips 1802.

Result of the Experiment.

Half Roods.	Manures.	Acreable Produce. Tons.	Cwt.	lbs.
No. 1.	3 Tons of long straw dung - -	18	6	6
2.	2 Tons rotten ditto - - -	16	1	4
3.	15 cwt. straw burnt - - -	8	3	7
4.	No manure - - - -	0	1	8

SIR,

AGREEABLE to your request, I send you the result of the experiments, intrusted to my care.

Feb. 22d, 1803. The four half roods (manured and sowed with turnips, the preceding year, according to your directions, of which I sent you an account) were sowed with barley, on one ploughing for comparison.

Produce.

	Bush.	Pecks.	Quarts.		Bush.	Pecks.
No. 1. Stable manure -	3	3	2	or per acre	30	2
2. Rotten ditto -	4	2	3	-	36	3
3. Burnt straw - -	3	3	1	-	30	1
4. Without manure	1	3	3	-	14	3

This experiment shews the importance of manuring, and the great benefit arising therefrom in this crop; but the true value of it cannot be ascertained, unless the rotation was completely finished, and an accurate account kept of each crop, the next of which will be clover, succeeded by wheat, which finishes the rotation. You likewise requested me to try the same manures for beans at spring, which I did on one acre, and on another acre for potatoes:—the following is the result.

Four roods were measured off on a poor gravelly soil, worth about ten shillings per acre; 1802 it produced barley; 1801 potatoes.

April 13, 1803, manured in the following manner.

No. 1. One ton of dry straw, spread equally over and burnt.

2. Three tons of stable manure, in a straw state.

3. Two tons of rotten dung, from the same materials.

4. Without manure.

Each sowed broad cast, with five pecks of beans and peas, mixed and ploughed in.

Produce.

	Bush.	Pecks.	Quarts.		Bush.	Pecks.	Quarts.
No. 1. Burnt straw -	2	0	3	or per acre	8	1	1
2. Stable manure	2	1	2	-	9	1	0
3. Rotten dung -	2	1	0	-	9	0	0
4. Without manure	1	3	0	-	7	0	0

A miserable crop; failure I attribute chiefly to the soil being too light, the season too dry, and, according to my other experiments, sowed too late. The manures are all of some, though very little service. Stable manure here has a trivial superiority. White peas adjoining them without manure a good crop, a proof the soil is more adapted to them.

April 15, 1803. Four roods were measured off in the same soil, and three of them manured, exactly in the same manner as the preceding ones, and one without for comparison. Planted with potatoes, seven bushels and a half each rood.

Produce.

	Bush.	Pecks.		Bush.	Pecks.
No. 1. Burnt straw - -	25	1	or per acre	101	0
2. Stable manure -	20	2	-	82	0
3. Rotten dung - -	24	1	-	97	0
4. Without manure -	19	0	-	76	0

The potatoes produce the worst in these parts, this year, I ever remember. Burnt straw here has the superiority. It is a pleasing reflection, that crops of potatoes and turnips may be procured with such offal straw, when a farmer may have no other manure, particularly turnips, as if that crop is missed, the whole rotation suffers most materially. I have sowed both acres with wheat, which may be ascertained, if you think it advisable. The wheat here suffers greatly from the mildew this year.

I am, Sir, &c.

Pickworth, Oct. 29, 1803. JOHN WRIGHT.

SIR, Pickworth, March 5, 1804.

I RECEIVED yours dated the 28th ult. requesting my account of the expences incurred, in my experiments upon manuring. In answer to which, as they were attended with but little loss, I shall make no pecuniary charge; should the Board consider me worthy any honorary mark of their esteem, I shall think myself amply

rewarded. I can only add, any experiments the Board may think proper to intrust to my care, shall be conducted with all the zeal an individual attached to the cause, is capable of.

I am, Sir, &c.

JOHN WRIGHT.*

SIR,

Pickworth Feb. 18, 1805.

THE following is an account of the experiments on hand, clover after turnip barley, an account of both which crops I have sent you some time back.

	Half Roods.	Cwt.	Stone.†		Cwt.	Stone.	£.	s.	d.
No. 1.	Stable dung once mowing	2	4	per acre	20	0 value	1	10	0
2.	Rotten ditto -	2	5	-	21	0	1	11	6
3.	Burnt straw - -	2	2	-	18	0	1	7	0
4.	Without manure -	1	0	-	8	0	0	12	0

The value of the feed before and after mowing, will about pay the expence of getting the crop. Rotten dung has rather the superiority, though not much. Burnt straw rather begins to decline; it produces, however, still more than double; that without manure is a proof, that in this poor soil manure is indispensably necessary; indeed it will not near pay the expences of cultivating without. My farm begins to tire most miserably of clover, so much so, that I am cultivating sainfoin for hay, and rye-grass for feed, though the land is not left in near so good a state for after crops.

Produce of the four Roods of Wheat after the Beans before registered, the Soil the same as the preceding; but being nearer to the Farm-yard, is more productive.

	Bush.	Pecks.	Quarts.		Bush.	Pecks.	Quarts.
No. 1. Without manure	3	2	0	per acre	14	0	0
2. Rotten dung -	3	2	0	-	14	0	0
3. Stable dung	3	2	3	-	14	1	4
4. Burnt straw -	3	2	2	-	14	1	0

* The Silver Medal of the Board was voted to Mr. Wright.

† 14lbs. to the Stone.

Produce of the four Roods of Wheat, after the Potatoes before registered.

	Bush.	Pecks.	Quarts.		Bush.	Pecks.	Quarts.
No. 1. Without manure	3	2	3	per acre	14	1	4
2. Rotten dung -	3	3	5	-	15	2	4
3. Stable dung -	4	0	0	-	16	0	0
4. Burnt straw -	4	1	1	-	17	0	4

Superiority one bushel, two pecks, and four quarts, which at 7*s.* 6*d.* per bushel, the mean price it should sell at, amounts to 12*s.* 2*d.* which with the superiority the year before of £3. 12*s.* makes £4. 4*s.* 2*d.* advantage, between planting potatoes and sowing beans, with the same management. The burnt straw in this experiment, beats all the others.

It appears extraordinary, that the manure upon the bean land, has been of very trivial service indeed, to either the bean or wheat crops. I shall be glad to hear from you, as soon as convenient, whether I shall proceed, or whether you have any new experiments.

I am, Sir, &c.

JOHN WRIGHT.

(These experiments continue till the courses are finished.)

No. XXVII.

On the Wire Worm. *By* Thomas Marsham, *Esq.*

DEAR SIR,

Baker-street, May 21, 1803.

I RECEIVED your letter of the 15th instant, enclosing a note from Mr. Young to you, and accompanied by a phial, in which were several larvæ, and an Iulus. The latter is the *Iulus terrestris*, a little animal frequently found in the roots of lettuce, cabbage, &c.; it is generally met with in a cavity of the root, which, I presume, it has itself hollowed out by feeding on the substance.

The larvæ are the first state of the *Elater segetis*, Gmelin, Vol I. Part 4, page 1915, No. 114; and of Bierkander, Act. Holm, 1799; the latter Gentleman has given a very particular account of their history; he observes, that they remain in the larva or grub state for five years, and during that time do much damage to the corn; in some fields from four to ten worms have been found in the space of a square ell. While the fields lie fallow they subsist on grass and other vegetables, from which, he observes, that those fields suffer most where the fallow is not kept clean and free from couch-grass and weeds: he proposes many methods of cure, but thinks none equal to children following the plough and picking up these larva and putting them into a bottle. But this accurate observer has discovered that nature has furnished allies to the farmer, and that a small ichneumon destroys a great number, but he was not fortunate enough to breed this fly, and therefore could not determine the species. De Geer has well described this larva also, in a chapter entitled " De quelques Espèces de Larves, dont les transformations sont inconnue, etc." in the 8th Mémoire of his 5th volume.

I am glad to find that country gentlemen begin to turn their thoughts to this subject, as it may tend to enable us to lessen the damage annually sustained.

I am, Sir, your obedient servant,

THOMAS MARSHAM.

Right Hon. Sir Joseph Banks.

Description of a highly pernicious Root Worm, by Clas. Bierkander, *from the Transactions of the Academy of Sciences in Sweden, 1779. Communicated by* Thomas Marsham, *Esq. to the Right Hon. Sir* J. Banks, *Bart. P. R. S.*

THE *grub* is yellow, the head brown with the extremities of the jaws black, the body is composed of twelve joints, shining and hard skinned; when it changes its skin, it is for some time white; a few hairs are scattered here and there, but mostly upon the head and last joint; under the three first joints are six horny and pointed feet, and at the beginning of the last joint, which is round, there are two black spots one on each side, which are, probably, apertures through which it breathes.

The *pupa* is white, three lines long, eyes black, over which are two brown horns; the breast is smooth and round, antennæ moniliform; the belly has ten joints, the last of which is furnished with two fine points in the corners.

Elater segetis; the whole body black; the antennæ brown, and the length of the breast. The elytra have longitudinally black and brown lines. Feet black, with the last joint brown.

After having fed these worms with corn roots in jars for five years, some of them at length, this year, in the month of July became a *papæ*, from which, about the tenth of August, the *elater* appeared in its perfect state. This length of time before they undergo a change was the reason why they were not described with the other root worms.

These worms are the husbandman's partners in wheat, rye, barley and oats. After a long fast, in the spring and autumn they have good appetites. I have often observed that a single worm has bitten from 8, 12 to 20 stalks in one place; when one destroys so much, what may not many thousands do? They object most to low places, for which reason the greatest damage is done in the ridges. In a square ell* turned with a spade in some fields 4, 6 to 8 worms have been found.

While the fields lie fallow they subsist on grass and other vegetables, from which, it is evident, that their increase is encouraged when the fallows are not taken care of, when couch and other sorts of grass grow in them, and when there are many and large balls or plots of grass in the fields.

As juniper berries do not all ripen in one year, so it is also with these vermin; some are a line long, some half grown, and others full grown and ready to undergo their

* Four square feet.

change; it is, therefore, more than one year that each worm has an opportunity of destroying the corn in the blade.

I have made many experiments to discover by what means they may be destroyed. Many were put at one time into tea cups filled with the following vegetables, viz.—

	Days.	Hours.
Garlic, among which they lived -	9 -	0
Spruce leaves, - - - -	0 -	14
Fir leaves, - - - -	0 -	10
Ledum palustre, - - - -	0 -	9
Myrica Gale, - - - -	0 -	2
In water they lived - - -	4 -	0

In consequence of this it ought to be tried, how useful it might be in winter and summer to mix in the heaps of manure, fir leaves, ledum palustre, and myrica gale, of which vegetables the dung would smell, which might probably be disagreeable to the vermin; and if they did not die in consequence of it, they might, perhaps, quit the fields.

To mix, as some agriculturists recommend, cut garlic as a remedy against root-worms, among the rye, and let them lie together a day or two before it is sown, it appears would be of no avail against this sort, for they live among this vegetable many days, and instead of flying from the smell they creep into the bulbs, and also remain in the earth where they grow.

Where there is an opportunity of laying the fields under water and drown these robbers, the process would be tedious, as they will live many days in water.

As these destroyers are always in the earth, the birds* cannot diminish their numbers; nature has, however, furnished allies against this army of vermin, as an ichneumon, by means of its aculeus or egg tube, if I may so call it, insinuates its eggs into many of them, so that in thirty worms which I have taken, I have found six that have been thus quartered upon. From one of these worms, with the loss of life of the host, 6, 10, 13 to 20 guests have come out. Which ichneumon this is, I have not yet discovered, as the *pupa* put into jars have all died.

In a field where rye was intended to be sown, I last autumn employed a child to follow the plough and pick up the worms; by this means 351 worms were collected

* There are no rooks in Sweden.

in a piece of land 600 feet long and 56 broad. The quantity which was taken in other fields was not counted. There were caught in the furrows, according to their length, 4, 6, 10 to 14 worms. It would be serviceable if children always followed the plough and gathered these yellow worms into a bottle, they would by that means be considerably diminished, and perhaps, in time entirely exterminated.

These enemies not only plunder the ploughed fields, but also meadows and gardens. In these places are also seen larger and broader yellow worms, which are the larva of another species of *elater*. Of these there is a drawing in De Geer's Mémoires sur les Insectes, Vol. V, Feb. 5, fig. 23, 25, something different in shape from the larva of *elater segetis*, which I have described.

As this grub attacks wheat, rye, barley, and pulse, it has not occasioned any error in the supposed transformation of corn.

The 14th June a worm drew from its mouth a thread eight inches in length.

My lot and my pleasure has been to investigate root worms, as to their nature, manner of living, and qualities. Posterity must discover some more fortunate method to exterminate or diminish them.

No. XXVIII.

Experiments with Urine as a Manure. *By Dr.* Belcher.

My Lord,

Chapel-street, Bedford Row, Jan. 13th.

My friend Dr. Belcher, who so essentially assisted me in that part of the economy of nature which respects the vegetable system, has been lately engaged in some experiments on the action of certain salts on vegetation. As I am, therefore, desirous of communicating any thing in this way which may be useful to the public, through the proper channel, I requested from him a short account of these experiments, that they might be laid before the Board, should your Lordship approve of them.

Your Lordship will, I trust, excuse the trouble I give you in transmitting them through your Lordship's hands. Should you think them of any importance, you will introduce them to the Board in any way you think proper. I believe the matter has not escaped the notice of the Board, but the carelessness of farmers in losing the most valuable part of their dung cannot, perhaps, be too often reproved. A similar experiment was made upon a larger scale by a neighbour of mine at Leyton, who watered, I think, *one half* of a grass field with urine, and that part of the field produced nearly a double crop of hay, in comparison with the other.

Your Lordship's much obliged,

G. Gregory.

Two Experiments on the Salts of Urine, with Remarks.

The powerful effects of urine in promoting vegetation are generally known; but I do not recollect to have met with any experiments on its salts, tending to shew their distinct effects. There are two sorts of salt in urine: the soda phosphorata, or phosphorated mineral alkali; and the ammonia phosphorata, or phosphorated volatile alkali.

On the 11th of August, 1803, I filled three flower pots, holding about a quart each, with sifted gravel from Epping Forest. No. 1, was left unmanured; No 2, was manured with five grains of soda phosphorata; and No. 3, with five grains of ammonia phosphorata. On the same same day I sowed nine seeds of garden cress in each pot; which were equally supplied with water, by pouring it into pans in which the pots were placed.

On the 18th of August, the plants had made their appearance in all the pots, and there was no perceptible difference. On the 26th, the plants in No. 2 and 3 were about equal, and greatly superior to those in No. 1. I find that I that day diminished the number of plants, leaving five of the strongest in each pot. On the 3d of September, the difference was still increasing in favor of the manured pots. On the 27th of September, I put an end to the experiment, and weighed the plants, the roots being cleansed. Plants in No. 1, 40 grains; No. 2, 180 grains; No. 3, 188 grains.

Thus it appeared that so small a weight as five grains of these salts of urine was capable of making the produce more than quadruple. The difference in their effects, weight alone considered, does not seem to have been remarkable; yet the appearance of the plants in No. 2 and 3, was very different. The weight of the plants in No. 2 lay chiefly in their stems, and two of the plants shewed blossoms. Of those in No. 3, the weight was principally in the crowns and roots, and only two of them had begun to advance their flower stems. I was afterwards sorry that I did not weigh the tops and roots separately, as the results must have been remarkable. Though the experiment lasted but forty-seven days, I am convinced that the plants in No. 2 were, on an average, 10 days more forward than those in No. 3, and at least fifteen forwarder than those in No. 1. Whether the soda phosphorata will in general hasten the maturation of vegetables, deserves further trial. The ammonia phosphorata, however, not only yielded a greater weight of vegetable matter, but from the abundance of root, and the superiority of colour in the plants manured with it, evinced in this experiment, and in others which I have made, an evident superiority. I believe the ammonia phosphorata to be the cause of the luxuriant vegetation of corn at those places where the urine or dung of animals happens to fall.

I have made an experiment with these salts on a bed of Swedish turnips in my garden. The ammonia phosphorata, in the quantity of sixty grains to a yard square, has had an excellent effect. The soda phosphorata has also had a powerful effect,

but of an opposite nature. For a time it seemed to be useful, but suddenly the plants manured with it were seized by the - - - - - - a small yellow worm with many legs, which abounds in this neighbourhood. The plants have been entirely destroyed on that particular spot where the soda phosphorata was used. The spot manured with the ammonia phosphorata has apparently escaped. The other parts of the bed are injured considerably. When I state these marked effects from manures at the rate of sixty grains to a yard, which is no more than forty-one pound and an half avoirdupois upon an acre, I am almost fearful of incurring the suspicion of exaggeration.

I cannot conclude these remarks without alluding to the importance which the ancient agriculturalists attached to the preservation of urine. Columella Book the 4th, Chapter the 8th, directs urine to be prepared and used as a manure for vineyards: he is so particular in his directions as to state that six sextarii or pints should be allowed to each vine. The practice of most modern farmers is as opposite as possible; for they not only suffer the urine of their cattle to flow away, but generally have their dung heaps so situated that they are drenched and impoverished by rain, which conveys their most valuable ingredient into the next river. The more cumbersome materials which the water can neither dissolve nor sweep away are frequently alone reserved, to be bestowed, at a great expence, on the defrauded land.

The quantity of most valuable manure which may thus be carried away is greater than is, perhaps, imagined. A few days ago, I obtained more than half an ounce of dry fetid substance from one quart of human urine. Supposing the urine of cattle to be equally productive, every hogshead of it which flows out of a farm yard, without even any impregnation from the dung heap, carries away seven and an half pounds of solid matter.

No. XXIX.

Copy of a Letter from Dr. Campbell, *to Lord* Carrington, *dated Fort Marlbro', March 5th, 1804; together with the duplicate of a letter inclosed (the original of which was sent by the* Culland's Grove, *captured on her passage home.)*

My Lord,

Fort Marlbro', March 5th, 1804.

Although much oppressed by languor, the consequence of a late violent illness, I avail myself of the present opportunity to address these few lines to your Lordship, inclosing a duplicate of a letter written by the Culland's Grove. By that vessel I transmitted some specimens of the nutmegs produced on this coast; but we have learned that she was captured on her passage home.

Since that period the trees have ripened their fruit, and, considering the short time which has elapsed since we imported them from Bandia, (in 1798,) we may be perfectly satisfied that they have found here a congenial climate and soil.

The cloves also are now perfecting: some of the clusters, in the specimen I forward by this conveyance to Sir Joseph Banks, are further advanced than is supposed necessary in preparing them for the market. We have thus attained a very interesting certainty; and, I trust, not only the Court of Directors, but the nation at large, will contemplate with satisfaction our growing hopes. No part of India has yet been found so favourable to their culture: at Bengal they languish.

Late importations have put us in possession of upwards of 22,000 nutmeg plants, and 6,000 cloves. These are planted out, and partly distributed to the natives, who take much interest in their culture; for they are willing to reap advantage, when their labour is not such as to press upon their habits of indolence; and these plants, after the first year, are hardy in the extreme.

I have requested Sir Joseph Banks to shew your Lordship the progress of our endeavour in the specimens now transmitted; indeed, I may rather say the accomplishments of our most sanguine hopes. For as we shall begin in a few months to raise from our own bearing trees, I cease to consider the spices as exotic to this island, and may assert that they are absolutely naturalized. My illness, and the

claims of a very extensive correspondence, hinder me from preparing a separate parcel for your Lordship, as I intended.

I have not addressed the Board of Agriculture, but entrust to Sir Joseph Banks's care a small cask of teak seeds for our western colonies: more at present I cannot. I am anxious about the fate of a consignment of much variety, sent to your Lordship in the Fame, extra ship, which sailed from this a few days later, I think, than the Culland's Grove.

May I request your Lordship to assure the Board, that returning health shall recal me to my labours; although, I fear, the eventful times in which we live will permit of little leisure to cultivate the arts of peace.

Permit me, my Lord, to solicit the honour of your Lordship's future correspondence upon any subject which may attract your regard respecting India or its productions, and to express my most sincere remembrance of the polite attentions I received from your Lordship, during the time you presided over the Board of Agriculture.

I have the honour to be, &c. &c.

C. Campbell.

The Right Hon. Lord Carrington.

(DUPLICATE)

My Lord,

Fort Marlbro', (date mislaid, but sent in the Culland's Grove).

I hasten to acknowledge my high sense of the honour the Board of Agriculture has conferred on me, by voting me their gold medal, and of the flattering manner in which your Lordship has communicated their resolutions. It shall be my chief solicitude to continue to forward, as far as in my power, the benevolent purposes of an institution, so well calculated to advance the general interests of mankind.

The remoteness of these regions; the local circumstances which render them inimical to colonization; and the precarious tenure by which they are held, render it greatly desirable that their peculiar advantages should be speedily transferred to countries long cultivated and civilized, and more immediately within the range of the arms and commerce of Britain. Under your Lordship's auspices, I have every hope that this may be effected; and that at no distant period, even the staple of this coast, its black pepper, shall become an export from the West Indies. My own

success, in naturalizing to this climate the spice plants of the Moluccas, has extended my views on this subject. The nutmegs here, imported from Bandia about five years and a half ago, are now perfecting their fruit, and I am forming extensive nurseries for future plantations. A specimen of the first crop, not yet wholly ripened, goes in the Culland's Grove, for your Lordship's inspection. They were placed and introduced under my care, by Mr. Robert Broff, formerly Governor here, and now residing in London: a gentleman whose consideration and enterprize merit well of his country.

I have somewhere received an obscure intimation of the pepper vine having found its way to French Guiana. If this is certain, the island of Jamaica may be supplied with slips of it, without hazarding a distant voyage. If my information is erroneous, permit me suggest to your Lordship, that it would be worthy of the liberal spirit of the House of Representatives of Jamaica, to send hither a light-sailing vessel direct, for the purpose of introducing to their island this interesting plant, with many others, which, from the nature of their seeds, can only be conveyed in the living state. Of these are the whole tribe of Eugenias, the Mangustian cynometras lancais, and indeed almost all the varieties of our most exquisite fruits. Of the sugar cane, we have here not less than fifteen kinds; many of them superior to those cultivated in the West. The true cardamom of Sumatra is yet a desideratum, and I could promise the nutmeg in profusion, in the course of another year. Should such a measure ever be taken into contemplation, I will exert my utmost endeavours to give it success. It were necessary that I should be apprised of it, at least, ten months previous to the arrival of the vessel, that the plants might be firmly rooted in boxes, and that she should be upon the coast in the months of October or November, so as to be able to leave it during the rains.

Such seeds as the season permits me to select, will be put on board the Fame, which sails somewhat later than the Culland's Grove; and I am willing to delay closing my little packet to the last, in the hope of adding to their number.

My Lord, your Lordship's most obedient,

C. Campbell.

The Right Hon. Lord Carrington, P. B. A.

No. XXX.

Reasons for giving Lands to Cottagers, to enable them to keep Cows. Addressed to the Right Hon. Lord Sheffield, *President of the Board of Agriculture, &c. &c. By* Thomas Thompson, *Esq.*

My Lord,

Hull, October 28th, 1803.

Under your Lordship's auspices, I hope that the Board of Agriculture will still retain all its energies, and be productive of increasing advantages to the nation: and it is certainly much to the honour of the Board, that its exertions are not confined to the improvement of the culture of land only, but are extended to the amelioration of the condition of the industrious poor.

It is demonstrable to every person who is acquainted with the state of the poor in the small towns in this country, that an appropriation of a few acres of land, to enable the industrious and honest cottager to keep a cow and a hog, would afford him such comforts and advantages as he is now entirely deprived of; and I hope it may be shewn that those comforts and advantages may be enjoyed by the cottager, not only without prejudice to the land owner and farmer, but to their real profit.

In the parish of Humberstone, in the county of Lincoln, there have been for some years, several cottagers who have had grass land, on which they have kept one or two cows each, exclusive of the land immediately adjoining their cottages, which is more than is necessary for potatoe gardens. About thirty acres of land are let to them for a summer pasture for their cows, and nearly the same quantity of meadow land, for the purpose of growing hay for winter food. The summer pasture is occupied by the cottagers in common; but the land on which the hay is grown is divided into proper portions, by short boundary posts, in order that each cottager may know his own land, and have the benefit of improving it by laying his manure upon it.

On this estate a farmer died about four years ago, leaving only an unmarried, elderly female relation, who wished to occupy a small portion of the farm. She

was possessed of considerable property, and in fact, the land which she wished to keep, was intended rather as a matter of amusement than of profit. There could be no reason, therefore, why part of this farm should not be given to such poor persons in the town, as could purchase a cow and a pig, and knew how to manage them.

The liberality of my noble friend, Lord Carrington, the owner of the estate, left me at liberty to fulfil his wishes and my own, in any way I thought best; and after I had fixed upon five or six poor persons of unblemished character, who were deserving of all the kindness that could be shewn to them, I was resolved, on a day appointed, to execute my purpose of giving each of them a small quantity of land.

Various difficulties arose in settling with the farmers, the small exchanges of land which it was necessary to make, and the compensation to be made for other trifling alterations, which the execution of the plan required. The poor who hoped for a few acres, out of the many hundreds in the parish, were waiting with the greatest anxiety for the result. It was an important day to them. The occupation of a few acres of land was of as great consequence to them, as the acquisition of thousands of pounds to many of their superiors. One was a day labourer, another a weaver, another a blacksmith, another a shoemaker, another the schoolmaster,—all very industrious and useful men in the town in their different professions. One had maintained a large family of children, by his daily labour, another had supported an aged mother, when he might have left her to be supported by the parish, and a third had spent a great proportion of his earnings in building a small dwelling-house on a piece of ground belonging to the owner of the parish.

It was at length settled that these poor persons should each have as much land as was necessary to keep a cow, and there are now in the parish about *eighteen* cottagers, who keep cows and pigs, and have little gardens, adjoining their houses.

When estates are let on lease, no land can be obtained for the cottager, without the consent of the farmer; and if one farmer agree to give up three or four acres of land, it is probable that another will not; so that it is difficult to do any thing of importance for the relief of the the poor in this way, at such places. But when leases expire, new arrangements may be made; or when a tenant dies, it is possible that it may be of little consequence to his relations whether they occupy the farm or not, and it may then be easy to lay hold on a sufficient quantity of land to apportion to cottagers.

I know how difficult it is to persuade large farmers that it would be their interest to give up small portions of land to poor persons. It is by no means uncommon for a farmer who holds three or four hundred acres of land to complain, when his landlord interferes to take from him three or four acres for a cottager, that his farm is essentially injured by it, and that some of his best land is taken from him. This unwise conduct, which leads the farmer to regard only the interest of the present moment, and to disregard the state of his poor neighbour, is often punished by its own consequences. Both the price of labour, and the poor-rate are increased by it, and the loss to the farmer is far greater than the loss of profit by three or four acres of land.

I am thoroughly convinced that it would be the interest of every farmer to give up a few acres of his land to every honest industrious labourer whom he employs. But I know few farmers who had not rather increase than diminish the size of their farms; and except from individuals of enlarged and benevolent minds, I expect no concessions by which their immediate interests may be affected. I respect the men, and think that I know their disposition and habits so well as to be in no danger of contradiction in what I say of them.

In some parts of England the greatest inconvenience is sustained from the want of labourers in harvest time, and I have seen different kinds of corn shaking on the ground because no man could be hired to reap it. The enormously high wages which are frequently paid to labourers in the summer, are a great deduction from the profit of the farmer, and in reality, therefore, a great burden on the land. But if cottages were built, and a sufficient quantity of land added to them, to enable the labourers who should be placed in them to keep cows, the farmer might constantly have labourers at hand, of known good character, on whom he could rely for assistance in time of need, and he would not be obliged to hire strollers from Ireland or Scotland, of whom he knows nothing.

On the estate which I have mentioned, no person in possession of a cottage and its appendages, has, within my knowledge, applied for parochial relief, unless on the loss of a cow, or in consequence of great age and infirmities. In ordinary cases of sickness, the cottager derives from his cow and his garden, the means of comfortable support; and with the addition of the few pounds which he may have saved while in health, he has been enabled to struggle through afflictions, under which he must otherwise have sunk.

But an increase of cottages, with a few acres of land added to them, would greatly tend to increase the population and strength of the country.* Prudent yearly servants are often deterred from marrying, by the difficulty which they find in obtaining cottages to reside in. Milk is essentially necessary to the support of children, and where that is not to be had, the children of the poor often undergo great sufferings, as nothing which is equally nutritive or proper for children can be substituted for it.† In cottages are born the manufacturers, and the soldiers and sailors of the nation, to whom we are indebted for our wealth and the protection which we enjoy in the use of it. The strength of a nation consists in the industry and number of its people, and that strength springs principally from the cottages.

In the choice of a cow, the cottager should call in the assistance of some neighbouring farmer, in whose judgment and integrity he can confide. The Holderness breed are generally bought by the cowkeepers near London, as it is found from experience that they give the most milk. But cows which give less milk may possibly produce as much butter as those from Holderness. In general the quantity of both milk and butter will much depend on the sort of land on which the cow is kept. The unpleasant taste which is found in the milk of cows which feed on particular sorts of plants in the summer pasture, or on turnips, or any other food, may be removed by mixing a small quantity of salt petre *(nitre)* in the milk. A tea cup full of water, with a little salt petre dissolved in it, may be mixed with the milk as soon as it comes from the cow.

* In the sixteenth century, when English wool sold at an enormous price for exportation, loud complaint was made, that the "*sheep-mongers*" oppressed the King's leige subjects, by devouring the common pastures with sheep, so that the poor people were not able to keep a cow for the comfort of them and of their poor families; and rich men were severely reproached for letting houses and cottages fall to the ground, or pulling them down, "by which means whole towns became desolate, and like to a wilderness, no man dwelling there, except a shepherd and his dog." There was, certainly, reason for these complaints, and the conduct of landowners at that time, however lucrative to themselves, was destructive of population and injurious to the nation. *Vide* Strype's Memorials. Vol. I. p. 392.

† Poverty is extremely unfavourable to the preservation of children. In some places one half of the children born, die before they are four years of age, in many places before they are seven, and in almost all places before they are nine or ten. But this mortality is principally amongst the children of the poor, who cannot afford them the same support and attention as the rich.

At the same time, the cottager will find it greatly to his advantage to keep a *sow* for the purpose of breeding pigs, instead of a hog to kill in the winter. When pigs are scarce, it is possible that he may make nearly as much profit by a sow as by his cow.*

Cottagers should never buy the long-eared, long-legged, rough-haired, narrow-backed pigs, as they fatten very slowly, and require a large quantity of meat to keep them even in a tolerable condition. The thick, short, heavy pigs fatten the soonest, and on the least quantity of food. The cottager will find it his interest to take some pains to obtain a pig of this kind. The other sort ought to be driven out of the nation. It is surprising that farmers in general, have not attended more to the improvement of the breed of pigs.

In the Earl of Winchilsea's paper, on the advantages of giving land to cottagers, it is stated, that in one village where the labourers keep cows, that the poor-rate is not above *sixpence* in the pound. In the parish of Humberstone, the whole poor-rate last year was £52. The whole annual rental of the parish is £2,368. The poor-rate, therefore, was about $5\frac{1}{4}d.$ in the pound on the rack rent. Out of this rate only £31. or about $3d.$ in the pound, was paid to the poor who live in the parish. The remaining £21. or about $2\frac{1}{4}d.$ in the pound was paid to the poor who do not live in the parish, but in distant parts of the country, and of whose real character but little is known.

I state as a general principle that, the landowner may let his land to the cottager at the same rent as to the large farmer, and if the landlord build the cottage, the cottager will pay him interest on the money expended in building it. The landlord then loses nothing in the first instance by what he does; but in another way he gains a great deal. Whenever a farmer wishes to take land, one of his first inquiries is, What is the poor-rate? If he be informed that the poor-rate is only $5\frac{1}{4}d.$ in the pound on the present rental, he will consider what is the value of the land, after deducting that poor-rate, and all other charges, and he will offer to the landowner the remainder of the value, as the rent which he can afford to pay.

In the parish of Humberstone, there are 2,700 acres of land, which I calculate are worth, on the average, 20*s.* per acre to the occupiers, exclusive of the poor-rate.

* "As the poorest family can often maintain a cat or a dog without any expence, so the poorest occupiers of land can commonly maintain a few poultry, or a sow and a few pigs at very little." Wealth of Nations. Vol. I. p. 355. 8vo.

The annual rental of this estate would then be £2,700. But if the poor-rate were 2*s.* in the pound on this rental, *i. e.* £270. instead of £52. I should fix the rent of the land at £2,482. only, which would be a loss to the landlord of £218. *per annum.* If the poor-rate were 3*s.* in the pound, *i. e.* £405, instead of £52. the rent would be £2,347. only, which would be a loss to the landowner of £353. *per annum.*

In this statement I consider the poor-rate as in reality paid by the landowner, and I am not aware that the principle can be disputed on solid ground. An intelligent farmer will consider the rate for the support of the poor, in the same light as the rent which he pays to his landlord. It is a certain payment which is to be made out of the produce of the land, and therefore the produce is worth so much less to him. Hence, if he calculate on any sum as his profit, he must necessarily calculate what rent he can pay, after paying the poor-rate as well as all other charges.

I can only make a supposition of what the poor-rate might have been, in the parish of Humberstone, if the eighteen poor persons who now keep cows, had not been able to keep any. But I am certain that the landowner has suffered no loss whatever by giving them small portions of land, and he has made them comparatively rich, and attached them to himself and to their country by gratitude and interest, and has added to their happiness in an incalculable degree.

I know of no description of men who may promote the increase of cottagers in a greater degree than gentlemen's stewards. Few landowners, however inattentive to their own concerns, and ignorant of the state of their tenantry, would object to give a few acres of land to cottagers, provided they suffered no loss of rent by it; and in many instances, I know by experience, that stewards might give land to cottagers, even at an advanced rent, without laying out any money in erecting new buildings. In many parishes there are small habitations which have been built on the waste, or in solitary corners of the common, by the industrious day-labourer, who would think himself extremely happy if, while he was working for his rich neighbour who occupies hundreds of acres, and has cattle of all sorts in abundance, his wife could be employed at home in managing a cow and a pig.

It is certain that the steward who will do this, must take more pains than most stewards do. He must be well acquainted with the tenants of the estate, and with the poor upon it. He must look farther than the receipt of his salary, or the poundage for receiving the rents; and he must visit the estate oftener than he has probably done in time past. But I do not know that, in carrying this system

into effect, the steward will be under the necessity of visiting the estate oftener than he ought to do, if he consider himself bound to attend to the proper management of the land, the preservation of the fences, drains, and buildings on the estate, and the fulfilment of the various obligations of the tenants.

In many instances, if the steward will give a poor man leave to cut down one or two decayed trees, which are, perhaps, growing worse every year, and which the first high wind may possibly blow down, he will build himself a cow-house and a pig-stye, and convert the timber to various other purposes of essential convenience to him. There is no doubt indeed, but that many poor men would undertake to build themselves dwelling-houses also, if they were assisted with a small quantity of such timber as the estate produces, even if it were of the most ordinary kind.

But if the owner of the essate has no objection to build cottages at his own expense, of a common, or of a peculiar construction, the industrious and careful labourer will readily pay him a rent which is equal to an interest of 5 *per cent. per annum* for the money expended. A very neat and substantial cottage may be built for about £40. in the northern counties, and such as may readily be let at 40*s. per annum*, exclusive of the rent of the land, which may be annexed to it.

In order to increase the number of cottagers in the kingdom, it would be well if gentlemen of landed property would desire their stewards to report to them, How many cottages may be built on their estates, and how soon a proper quantity of land can be annexed to each? How many cottages are already built, and are now inhabited by industrious poor persons, who, if they had a few acres of land, could raise money to purchase a cow and a pig? How many are willing to build cottages at their own expense, if rough timber were given them, and land offered to them? But if the landowner would visit his estates, and make those inquiries himself on the spot, he might have the pleasure of doing the most extensive and lasting good to the deserving poor, whilst he was in reality increasing the value of his own property.

I write on this subject, *currente calamo*, and I wish that what I have said may deserve your Lordship's attention.

I have the honour to be, &c. &c.

THOS. THOMPSON.

To the Right Hon. Lord Sheffield.

No. XXXI.

On Potatoe Fallows. By John Cotes, *Esq.*

DEAR SIR,

Woodcote, Shropshire, April 26th, 1804.

IN your Agricultural Report of this County, you have honoured the introduction of two letters which I submitted to the Board of Agriculture, at a period of extreme pressure and scarcity. The result of experience, and deductions from all writers, having evidently proved, that the increased population of the kingdom greatly exceeds its supply, it becomes a debt, which every man owes to the community of which he bears a part, to submit such ideas as he may conceive important to its interests, more particularly on a point which he believes to be of import no less than to prevent the recurrence of those great and calamitous evils which attend on scarcities. Conceiving, as I sincerely do, that the strong arable soil of this island does not produce the half of what it might do, I shall venture to point out its defect. By such an undertaking, in its sound so preposterous, I am fully aware that I must necessarily incur prejudices, arising in various causes, both from the real practical man, as well as from a large body of those who believe themselves to be of that description. But in defiance of all, I will venture to assert, the object is to be attained by the operation of the common plough, independent of every other implement. I need not state, that plain and simple practice is best suited to that description of men, on whose labour and produce we depend for our existence. Of all men living, the common farmer is the least disposed to novelty,—still less will he be so if any alteration is to be made, either by extra labour, or the introduction of implements which will necessarily occasion expense. The receipt which I have the honour to propose, (for no other name does it deserve) shall be comprised in four monosyllables—

A TWO BOUT RIDGE.

A fit application of the land by means of this practice shall, I contend, create a *new earth.* That earth so created shall be a garden in its appearance, and in its

reality freed from every thing like a weed. To this I invite the practical men to decide—whether by this mode,

First, Having shewn them how I obtain my fallow;

Secondly, Having shewn them how I obtain my crop;

Thirdly, Having shewn them the crops so obtained, and the state of the land after *five* years culture of successive crops;

I say, whether on an investigation it shall not be found, that at the end of five years my practice shall have produced a double return, as compared with the returns made on the old practice from the wheat land farm. I shall further desire the practical man to say,—whether this advantage is not so obtained

By less labour;

By less seed;

By less manure;

and, above all, whether the land is not then, comparatively, left in a much higher state of cultivation?

The detail of a system can alone be fully explained by the *examination of its practice.* Even those whose talents give the advantage of ingenious display, will prevail to a very limited extent of benefit. Ingenious theory, however, is wholly out of my reach; my only attempt is plain and simple practice; to this I do aspire, and to this I call the enquiry of practical men to *examine on a view*, whether I am correct on the subject on which I have had the honour to address you

I wish to have it distinctly understood, that what I submit, attaches itself to the strong soil. The light soil has already attained its utmost perfection, *when fitly cultivated* under the turnip system. And surely it is not saying much, when I assert that the strong soil has all the advantage of superior quality over the light; and that it is as much more able to carry the greater bulk, as the person matured by age is able to carry a greater weight than the infant.

I am, &c. &c.

JOHN COTES.

The Rev. Mr. Archdeacon Plymley.

DEAR SIR, *Woodcote, April 27th,* 1804.

You have so honoured my humble efforts, that I have taken the liberty of stating the ideas I entertain of improved practice, by the letter which I presume to enclose. I have also taken the liberty of enclosing my letters to the Board of Agriculture, as you will see some amendments which are very material respecting the *size* of the *ridge*, and the introduction of the *bean* on the fallow. In the first, I conceive it *indispensible* not to go beyond the *two bout*, as this appears to me the only means by which the *new earth* is created; and this I consider a *sine qua non*. The introduction of the bean on the fallow is also very important, and much catches the opinion of my practical neighbours, many of whom are now cultivating their summer fallows according to this practice.

It should seem a bold position to say, that a farm of any given extent is able to keep the whole of its stock, during the winter months, for nothing. It sounds the language of a maniac; but when the subject is candidly considered, and the information looked for, *where alone it can be found*, in practice; I will venture to assert, that the practical man will confirm the position, wild and chimerical as it may at first appear. That the bean will supply the horses of a farm, and that the turnip will supply the cattle, has, I believe hitherto, never been denied. The only proof then wanting is, that these shall be had from the summer fallow, (which would otherwise render no produce) without injury to the land, or without additional expense, by means of the common plough. To this I covet the inquiry of the practical world. The intention of your effort is to me so laudable, and embraces a subject on which I have so very much turned my thoughts, that, at the same time that I am anxious to offer to you my tribute of acknowledgment for so much sound and instructive general knowledge, I cannot resist the opportunity it has given me of explaining ideas, the result of experience, which I feel would (under Divine Providence) afford ample plenty to this island, and for ever prevent the recurrence of scarcity. On this ground I feel assured of the indulgent reception of this intrusion, and will not offer further apology. I will only add the assurance of the sincere pleasure which the opportunity of shewing in practice those ideas, which I have thus

held out, would afford me, and to say that I should feel myself much honoured, whenever your leisure could give me the pleasure of seeing you at Woodcote.

I am, &c. &c.

JOHN COTES.

The Rev. Mr. Archdeacon Plymley.

Thoughts on the Means of affording an efficient Supply to the Country, addressed to Lord Carrington, *President of the Board of Agriculture. In two Letters. By* John Cotes, *Esq.*

MY LORD, *Woodcote, Shropshire, Dec.* 30, 1800.

INVITED by your Lordship's public appeal, I submit what I conceive may be an effectual means of contributing to the ample supply of the country. I am induced to do so, from the decided conviction, that an adoption of the most easy and plain cultivation imaginable, by only rendering that *useful* which is now *useless*, would introduce a greater plenty than the people of England could consume; and this by a practice which would neither require expence, the addition of an acre not already in tillage, or scarcely an additional trouble. I am aware how chimerical such bold assertions must appear; but the result of much practice, enables me to state, and that without the fear of opposition from the practical man, who will candidly investigate the mode, that, *the wheat fallow*, under the culture I subjoin, would produce abundantly more of that nutritious plant the potatoe, than the people of this country could want, to make up any possible deficiency in the wheat crops, and the fallow would be in no degree injured for its succeeding crops. The potatoe is well known to be the best substitute for wheat; and I speak with much confidence when I say, that under all circumstances, it will be found the only efficient one. It is also known that, the potatoe, occasionally in cultivation, precedes the wheat crop; but this is so rarely practiced, and then upon a system which so oppresses the land, as to keep this practice on a scale too limited to procure any general supply. I presume to offer a system which would render from each acre a considerable quantity, and yet the plant being set over only a *portion* of the land, would not oppress it.

The practice I submit is as follows:—

Plough a wheat fallow in two *bout ridges*. In the *furrow* put some dung—on that dung place the potatoe sets, and then plough *a bout* upon them: a *ridge* thus formed, gives a double portion of earth for the plant to grown in, and it has the benefit of the dung to root in. This applies to that part of the land which bears the *crop*, and which will form so many rows. The remaining part of the land will form so many alleys, in which, during the summer, the common operation of the plough will make the *fallow*; and thus crop and fallow be had without injury to the land. The fallow will, even in most cases, be amended, from the circumstance of some little additional trouble, which, for the sake of the potatoe crop, will be bestowed by the farmer beyond the tillage he usually gives to the summer fallow. The potatoe crop, thus obtained, is had from land otherwise wholly unproductive; and its value, perhaps, not inferior to any which may succeed it. Hence two crops, the immediate food of man, may be had within the same tillage; nor is it a little important, at this moment, that the potatoe crop would be had twelve months in advance: for, supposing the summer fallow of the approaching season to be thus applied, its potatoe crop would be returned next autumn, whereas the same land can only afford its wheat crop twelve months after. But the great difficulty, and which I know to be great indeed, and scarcely to be surmounted, is the prejudice with which any thing like innovation is received. Whether by a recommendation from landlord to tenant—whether by a bounty on the culture—or whether by any other means this difficuty is to be removed, it is not for me to say. It is solely for me to state the result of that practice which has given me so decided a conviction, and which, as it tends to the relief of my fellow-creatures, I feel it a duty to submit. I should apologize for taking up so much of your Lordship's time. I will not, however, trespass farther than to add, that if even a small portion of the summer fallow was applied under this culture, and the system extended to the different parts of the island, a greater supply of food would be obtained than any want could call for, and that, in lieu of precarious and expensive importation, we should be able to obtain from our own soil that produce which would render us independent of all foreign assistance.

I have the honour to be,

Your Lordship's most obliged and obedient servant,

JOHN COTES.

MY LORD, *Woodcote, January* 28, 1801.

I WAS so much aware of the objection which might be stated to the potatoe as "an exhausting crop," that I endeavoured very cautiously to obviate this difficulty, in the letter I had the honour to write to your Lordship; and if your Lordship and the Board will have the goodness to refer to it, it will be seen, that the system I propose attaches the crop to so small a *portion* of the land, and that in rows supported by dung, in which the plant is actually set, as to remove any thing, in my opinion, like objection on that head: the alley which constitutes the fallow, bears no crop, therefore cannot in possibility be exhausted: Indeed, I see the reverse in so strong a point of view, that I must desire to repeat what I stated in my last, that the land will even be in a higher state of cultivation to receive its succeeding crop, from the additional pains which the farmer will afford, in order to the more effectually obtaining of his potatoe crop. Nor did the probability of the second objection pointed out escape me, namely, "That of loosening the soil too much for wheat." Supposing this difficulty to occur, it might be obviated by sowing under furrow; but no such difficulty could exist, for the land I propose to apply, is of a texture which would not be reduced to too fine a mould. In this I am very anxious to be particularly understood as not applying my practice to that land which would otherwise be a turnip fallow; for although this, which is a light soil, might full as well grow the potatoe, yet this would not come up to my idea of rendering *useful* that fallow, which has hitherto been *useless*. It would only substitute one crop for another; and experience tells me, that the present unproductive wheat fallow would be brought to the use I propose, and supply more of that wholesome and nutritious food, the potatoe, than the country could want to make up any future deficiency in its wheat crop, if only a small proportion of the fallow could be thus applied, provided the system could spread itself to the different parts of the kingdom, and that its adoption would be fitly practised; for it matters not how good any system may be, if not acted up to: and here I know the great difficulty which must arise, for prejudices are not easily overset. Could this be effected, I would pledge myself, that this most easy practice would render a supply beyond possible want: for it does not rest as an experiment to make; I have practically made it again and again. There is another objection which may be, and I conclude will be suggested, and which I feel more forcibly than the others, yet by no means an obstacle. It may

be stated, that there will not be time enough to get up the crop so as to sow the wheat in its proper season: this, however, need not be the case, for the getting up of the potatoe will be very expeditious, when done by means of the plough, which, by throwing a furrow from each side the row, will leave the plant so exposed as to be very easily and quickly got. There are many counties where, in the course of cropping, the wheat does not immediately succeed the fallow. In this case, the objection could in no degree hold; nor need it, in any force, where the wheat does immediately follow.

I feel that I intrude much upon your Lordship's time and attention, but as the subject presses itself on my mind as one which, in so peculiar a degree, interests the lower orders of the community, I am satisfied I shall receive your Lordship's indulgence. The comparative view I have taken of the poorer orders of the people, where the potatoe is, and where it is not grown, has made much impression on me; and practice assures me, that an adoption of the system I have taken the liberty to suggest, would so amply return an abundant supply of this nutritious and wholesome food, as to equalize that comfort. It is my practice to allot a portion of land to my labourers, and to some of my poorer neighbours. The scarcity is now so great, that I shall likewise expect my tenants to give from ten to fifteen rods (a rod eight yards square) of fallow land to each of their labourers; and, in so doing, I consider they are giving that which is no loss or detriment to them. They are only giving that which would otherwise be unproductive; as the land is going on in its state of cultivation for the succeeding crop: and yet, at the time that they lose nothing, the poor man will derive his every comfort; he will derive that produce which will be the great staff to himself and family, and an overplus sufficient to feed his pig: hence he will obtain in a great degree, his yearly supply: he has then his weekly earnings for the portion of corn he may want, and oftentimes be able to procure some meat. Thus, I am sure, the poor man, who has his supply of potatoe within himself, is in greater comfort than he who, with double wages, has no such resource.

Your Lordship and the Board will easily infer how applicable the fallow intended for wheat may be made to other growth. Upon the precise same practice, I have cultivated, with much success, the bean, and the transplanted Swedish turnip. This latter would be a happy resource in dairy countries, which are mostly strong soils, and where the common turnip is not grown. The Swedish turnip has many properties,

and peculiarly fitted to the wheat land farm. But, my Lord, this is a digression which goes into the more general subject of agriculture, and therefore I will not pursue it. If any hints of mine can be rendered useful on the subject on which I have the honour to address your Lordship, I shall be most happy; if not, I shall have derived the comfort of imparting that mite of information which I have conceived useful to my fellow-creatures.

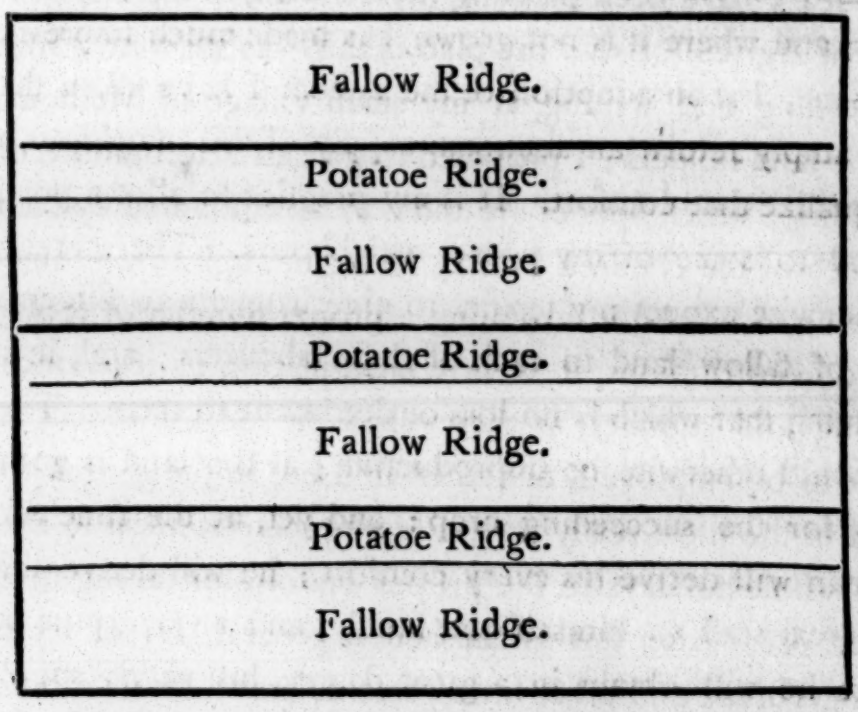
I have the honour to be,

Your Lordship's very faithful and obliged Servant,

JOHN COTES.

Lord Carrington, President of the Board of Agriculture.

The following is added as a Plan to illustrate the Fallow and the Potatoe Crop:



No. XXXII.

SEMINARY *for* AGRICULTURAL EDUCATION. *By Sir* Henry Vavasour, *Bart.*

London, Feb. 20th, 1805.

IT is now nearly two years since I first entertained the thoughts of improving in (I believe) a new manner, the condition of the inhabitants, and particularly the cottagers of my little village, for I know nothing of the manufacturing tribe, living in the East Riding of Yorkshire, where manufactures have scarcely yet made their appearance. The idea I have been pleasing myself with, is the establishment of an infantine Seminary of Agriculturists: my plan is this—as we were about to build a school-house for reading and writing, at my small village of Melbourne, by subscription amongst the land-holders; I proposed to give an acre or more of land to be attached to the building; which spot of ground is to be cultivated by the master, and for his benefit, by such of the children as may be big enough to do something in the way of weeding hoeing, &c. After furnishing a proper number of tools of the best and most approved constructions, it is in contemplation to give, once a week or oftener in the spring and summer, as there shall be occasion, half a holiday, to the children who are to be employed, or rather amused, in the garden or garth, and are to be instructed in the most ready way, in doing their business in the cultivation of it; having a few whole holidays in the proper season, for taking up the crops of potatoes, carrots, &c. &c. After this is finished, a general day of recreation is to take place, when gingerbread and other little presents are to be distributed amongst the children; and some particular distinctions are to be given to those who have shewn the most disposition to excel. I mean that this garth is to be cultivated in the Flemish or field-gardening husbandry; which, I am convinced, is the most proper mode of cultivation for a cottager or day labourer. The Board of Agriculture has already approved of this manner of cultivating land, by publishing four or five years ago, the crop of Thomas Rooke, a cottager on my estate, and in voting him a silver medal, for his great merit. In whatever condition of life these children may be placed, some knowledge of gardening and of the management of land, may,

probably be of use and comfort to them when they are grown into manhood; it will, at any rate, teach them to employ, rationally, many a leisure hour; and, it is possible, may lead them to spend their time more advantageously for their health and morals, than in the public-house. We mean to teach the bigger children the best approved modes of mixing manures by compost, and and the manner of grafting and pruning fruit trees, &c. &c. In case the school-master shall not be sufficiently able to instruct out of doors, he is to be assisted, in advice, by those near the spot, who will take the trouble of directing and superintending this little concern; two persons of considerable knowledge in husbandry and gardening are appointed, for the direction of this society, respecting the land. The house is now built, and some progress is making in the general plan; the inhabitants of the township are sending their children; at first they were shy of doing so, thinking that this little business of working was to be carried on for the benefit of individuals, at the expence of the sweat and labour of their little offsprings.

But, I make no doubt, their eyes will be opened, and that all differences will be smoothed, to our utmost wishes: as it has been wisely said that, "the man has some merit who makes a turnip grow where a turnip never grew before;" so, it is to be hoped, that this little seminary of agriculturists may in time become a public benefit; at least in the small circle it is intended to embrace.

No. XXXIII.

A Cottage Oven. By Sir C. Hawkins, *Bart. M. P.*

SIR, *Argyle-street, 5th Dec.* 1801.

THE plan of the stove which I mentioned to you I had built in the country, for the use my labour-men, having appeared to you to be suitable for cottages, I will beg of you to communicate the inclosed drawings of the stove to the Honourable Board of Agriculture.

By one fire the three operations of baking, boiling, and roasting may go on, at one time, without any increase in the consumption of fuel.

Even after the fire is extinguished the stove will contain a great heat for many hours if the door to the fire-place, the regulator, and the ash-pit are well closed.

But as this sort of stove has been thought too expensive for very poor persons, or small families, I will beg leave to mention, that by a small improvement of an honourable friend of mine, on the common cast iron pot, of the value of 1*s.* 6*d.* or 2*s.* with a cover, and a false bottom to prevent burning, and made to lift up with iron wires, all which will not cost more than 5*s.* it will bake and boil with the least quantity, or with any sort of fuel. It is said to bake bread much better than in a common oven. The cover should be made exactly to suit, and the fire should be placed on the cover as well as beneath the pot.

I remain, Sir, your most obedient humble servant,

C. HAWKINS.

To Arthur Young, Esq.

No. XXXIV.

On the Form of Animals.. By Henry Cline, *Esq. Surgeon.*

THE form of domestic animals has been greatly improved, by selecting with much care the best formed for breeding; but, the theory of improvement has not been so well understood, that rules could be laid down for directing the practice. There is one point particularly, respecting which the opinions of breeders have much varied, which is, whether crossing the breed be essential to improvement.

It is the intention of this communication, to ascertain in what instances crossing is proper, and in what prejudicial; and the principles upon which the propriety of it depends.

It has been generally supposed that the breed of animals is improved by the largest males. This opinion has done considerable mischief, and would have done more injury if it had not been counteracted by the desire of selecting animals of the best form and proportions, which are rarely to be met with in those of the largest size.

Experience has proved that crossing has only succeeded, in an eminent degree, in those instances in which the females were larger than in the usual proportion of females to males; and that it has generally failed when the males were disproportionally large.

The external form of domestic animals has been much studied, and the proportions are well ascertained. But the external form is an indication only of internal structure. The principles of improving it must therefore be founded on a knowledge of the structure and use of internal parts.

The lungs are of the first importance. It is on their size and soundness that the strength and health of an animal principally depends. The power of converting food into nourishment, is in proportion to their size. An animal with large lungs,

is capable of converting a given quantity of food into more nourishment than one with smaller lungs; and, therefore, has a greater aptitude to fatten.

The Chest.

The external indications of the size of the lungs, are the form and size of the chest; the form of which should approach to the figure of a cone, having its apex situated between the shoulders and its base towards the loins.

The capacity of the chest depends on its form more than on the extent of its circumference; for, where the girth is equal in two animals, one may have much larger lungs than the other. A circle contains more than an ellipsis of equal circumference; and, in proportion, as the ellipsis deviates from the circle, it contains less. A deep chest, therefore, is not capacious; unless it is proportionally broad.

The Pelvis.

The pelvis is the cavity formed by the junction of the haunch bones, with the bone of the rump. It is essential that this cavity should be large in the female, that she may be enabled to bring forth her young with less difficulty. When this cavity is small, the life of the mother, and her offspring, is endangered.

The size of the pelvis is chiefly indicated by the width of the hips, and the breadth of the twist, which is, the space between the thighs.

The breadth of the loins is always in proportion to that of the chest and pelvis.

The Head.

The head should be small, by which the birth is facilitated. Its smallness affords other advantages, and generally indicates that the animal is of a good breed.

Horns are useless to domestic animals, and they are often a cause of accidents. It is not difficult to breed animals without them.

The breeders of horned cattle, and horned sheep, sustain a loss more extensive than they may conceive; for, it is not the horns alone, but also much more bone in the skulls of such animals to support their horns, for which the butcher pays nothing; and, besides this, there is an additional quantity of ligament and muscle in the neck, which is of small value.

The skull of a ram with its horns, weighed five times more than another skull which was hornless. Both these skulls were taken from sheep of the same age, each

being four years old. The great difference in weight, depended chiefly on the horns; for the lower jaws were nearly equal, one weighing seven ounces, and the other six ounces and three quarters; which proves that the natural size of the head was nearly the same in both, independant of the horns and the thickness of bone which supports them.

In a horned animal, the skull is extremely thick. In a hornless animal, it is much thinner; especially in that part where the horns usually grow.

To those who have not reflected on the subject, it may appear of little consequence whether sheep and cattle have horns; but, on a very moderate calculation, it would be found, that the loss in farming stock, and also in the diminution of animal food, is very considerable, from the production of horns and their appendages. A mode of breeding which would prevent the production of these, would afford a considerable profit in an increase of meat, and wool, and other valuable parts.

The length of the neck should be proportioned to the height of the animal, that it may collect its food with ease.

The Muscles.

The muscles, and tendons, which are their appendages, should be large; by which an animal is enabled to travel with greater facility.

The Bones.

The strength of an animal does not depend on the size of the bones, but on that of the muscles. Many animals with large bones are weak, their muscles being small.

Animals that were imperfectly nourished during growth, have their bones disproportionately large. If such deficiency of nourishment originated from a constitutional defect, which is the most frequent cause, they remain weak during life. Large bones, therefore, generally indicate an imperfection in the organs of nutrition.

On the Improvement of Form.

To obtain the most approved form, two modes of breeding have been practised; one, by the selection of individuals of the same family; called, breeding in-and-in. The other, by selecting males and females from different varieties of the same species; which is called, crossing the breed.

When a particular variety approaches perfection in form, breeding in-and-in may be the better practice; especially for those who are not well acquainted with the principles on which improvement depends.

When the male is much larger than the female, the offspring is generally of an imperfect form. If the female be proportionally larger than the male, the offspring is of an improved form. For instance, if a well formed large ram be put to ewes proportionally smaller, the lambs will not be so well shaped as their parents: but, if a small ram be put to larger ewes, the lambs will be of an improved form.

The proper method of improving the form of animals, consists in selecting a well formed female, proportionally larger than the male. The improvement depends on this principle, that the power of the female to supply her offspring with nourishment is in proportion to her size, and to the power of nourishing herself from the excellence of her constitution.

The size of the fœtus is generally in proportion to that of the male parent; and, therefore, when the female parent is disproportionately small, the quantity of nourishment is deficient, and her offspring has all the disproportions of a starveling. But, when the female, from her size and good constitution, is more than adequate to the nourishment of a fœtus of a smaller male than herself, the growth must be proportionately greater. The larger female has also a greater quantity of milk, and her offspring is more abundantly supplied with nourishment after birth.

To produce the most perfect formed animal, abundant nourishment is necessary from the earliest period of its existence until its growth is complete.

It has been observed, in the beginning of this paper, that the power to prepare the greatest quantity of nourishment, from a given quantity of food, depends principally on the magnitude of the lungs, to which the organs of digestion are subservient.

To obtain animals with large lungs, crossing is the most expeditious method; because well formed females may be selected from a variety of a large size, to be put to a well formed male of a variety that is rather smaller.

By such a method of crossing, the lungs and heart become proportionately larger, in consequence of a peculiarity in the circulation of the fœtus, which causes a larger proportion of the blood, under such circumstances, to be distributed to the lungs than to the other parts of the body: and, as the shape and size of the chest,

depend upon that of the lungs, hence arises the remarkably large chest, which is produced, by crossing with females that are larger than the males.

The practice according to this principle of improvement, however, ought to be limited; for, it may be carried to such an extent, that the bulk of the body might be so disproportioned to the size of the limbs as to prevent the animal from moving with sufficient facility.

In animals, where activity is required, this practice should not be extended so far as in those which are intended for the food of man.

On the Character of Animals.

By character in animals is here meant, those external appearances by which the varieties of the same species are distinguished.

The characters of both parents are observed in their offspring; but that of the male more frequently predominates. This may be illustrated in the breeding of horned animals; among which, there are many varieties of sheep, and some of cattle, that are hornless.

If a hornless ram be put to horned ewes, almost all the lambs will be hornless; partaking of the character of the male more than of the female parent.

In some counties, as Norfolk, Wiltshire, and Dorsetshire, most of the sheep have horns. In Norfolk the horns may be got rid of, by crossing with Ryeland rams; which would also improve the form of the chest, and the quality of wool. In Wiltshire and Dorsetshire, the same improvements might be made by crossing the sheep with South Down rams.

An offspring without horns might be obtained from the Devonshire cattle by crossing with hornless bulls of the Galloway breed; which would also improve the form of the chest; in which, the Devonshire cattle are often deficient.

Examples of the good Effects of crossing the Breed.

The great improvement of the breed of horses in England arose from crossing with those diminutive stallions, Barbs and Arabians; and, the introduction of Flanders mares into this country was the source of improvement in the breed of cart horses.

The form of the swine has also been greatly improved, by crossing with the small Chinese boar.

Examples of the bad Effects of crossing the Breed.

When it became the fashion in London, to drive large bay horses, the farmers in Yorkshire put their mares to much larger stallions than usual, and thus did infinite mischief to their breed, by prooducing a race of small chested, long legged, large boned, worthless animals.

A similar project was adopted in Normandy, to enlarge the breed of horses there, by the use of stallions from Holstein; and, in consequence, the best breed of horses in France would have been spoiled, had not the farmers discovered their mistake in time, by observingt he offspring much inferior in form, to that of the native stallions.

Some graziers in the Isle of Sheppey, conceived that they could improve their sheep by large Lincolnshire rams, the produce of which, however, was much inferior in the shape of the carcase, and the quality of the wool; and their flocks were greatly injured by this attempt to improve them.

Attempts to improve the native animals of a country, by any plan of crossing, should be made with the greatest caution; for, by a mistaken practice, extensively pursued, irreparable mischief may be done.

In any country where a particular race of animals has continued for centuries, it may be presumed that, their constitution is adapted to the food and climate.

The pliancy of the animal economy is such, as that an animal will gradually accommodate itself to great vicissitudes in climate, and alterations in food; and, by degrees, undergo great changes in constitution; but these changes can be effected only by degrees, and may often require a great number of successive generations for their accomplishment.

It may be proper to improve the form of a native race, but at the same time it may be very injudicious to attempt to enlarge their size.

The size of animals is commonly adapted to the soil which they inhabit. Where produce is nutritive and abundant, the animals are large, having grown proportionally to the quantity of food which, for generations, they have been accustomed to obtain. Where the produce is scanty, the animals are small, being proportioned to the quantity of food which they were able to procure. Of these contrasts, the sheep of Lincolnshire, and of Wales, are examples. The sheep of Lincolnshire would starve on the mountains of Wales.

Crossing the breed of animals, may be attended with bad effects in various ways; and that even, when adopted in the beginning, on a good principle; for instance, suppose some larger ewes than those of the native breed, were taken to the mountains of Wales, and put to the rams of that country; if these foreign ewes were fed in proportion to their size, their lambs would be of an improved form, and larger in size than the native animals; but the males, produced by this cross, though of a good form, would be disproportionate in size to the native ewes; and, therefore, if permitted to mix with them, would be productive of a starveling, ill formed progeny. Thus a cross which, at first, was an improvement, would, by giving occasion to a contrary cross, ultimately prejudice the breed.

The general mistake in crossing has arisen from an attempt to increase the size of a native race of animals; being a fruitless effort to counteract the laws of nature.

The Arabian horses are, in general, the most perfect in the world; which probably has arisen from great care in selection, and also from being unmixed with any variety of the same species; the males therefore have never been disproportioned in size to the females.

The native horses of India are small, but well proportioned, and good of their kind. With the intention of increasing their size, the India Company have adopted a plan of sending large stallions to India. If these stallions should be extensively used, a disproportioned race must be the result, and a valuable breed of horses may be irretrievably spoiled.

From theory, from practice, and from extensive observation, which is more to be depended on than either, it is reasonable to form this

Conclusion;

It is wrong to enlarge a native breed of animals, for in proportion to their increase of size, they become worse in form, less hardy, and more liable to disease.

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